RCI-4000IS Tension Based System

OFFSHORE PEDESTAL CRANES

Instruction Manual

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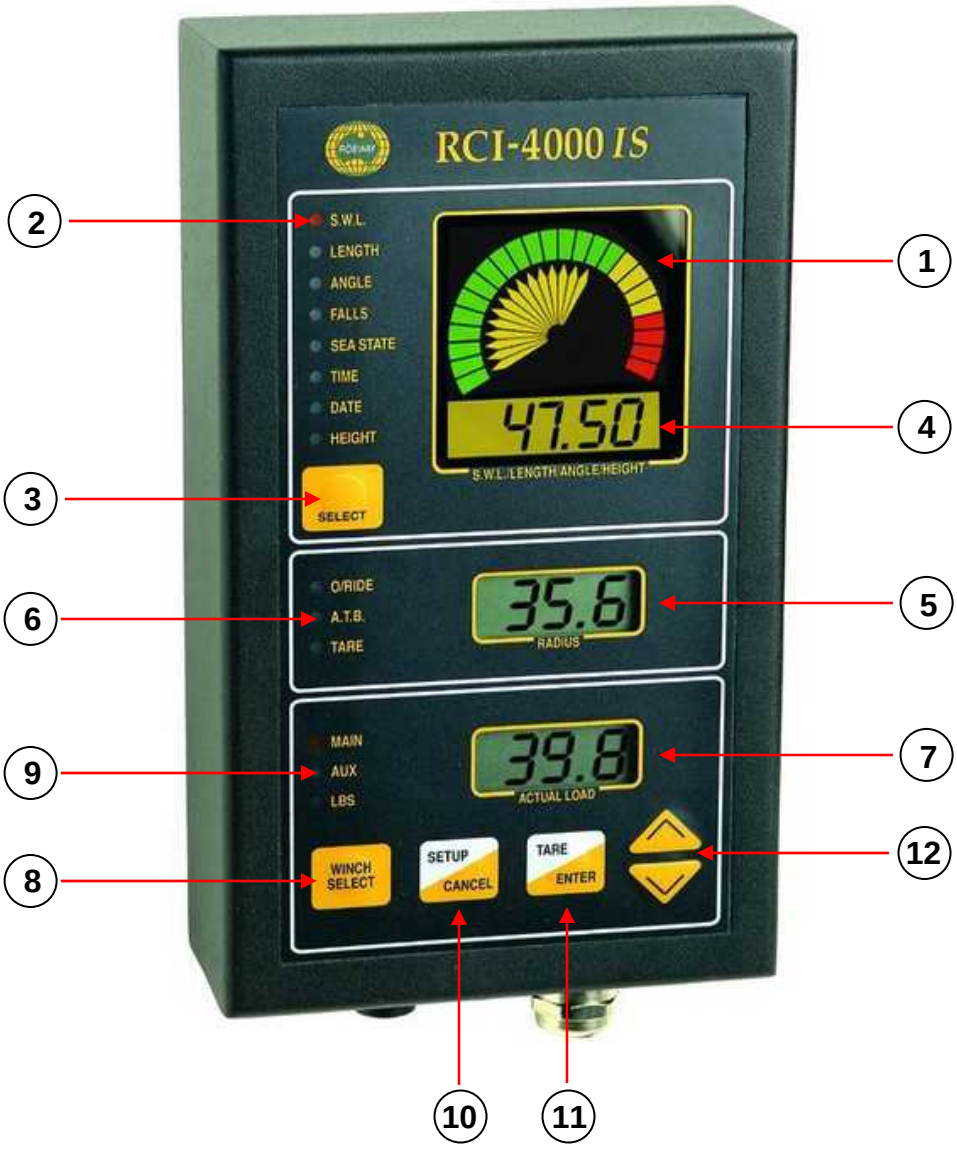
RCI-4000IS Operator's Display Functions



Description of each function

1 Percentage of SWL Capacity Display:

GREEN 50 to 85%

AMBER 85 to 100%

RED 100 TO 110% - all flash above 110% of SWL

All colours flash above 110% or Fault

2 LED Indicator Lamps

3 Multifunction Selector Key

4 Multifunction Display for **#2** Above

5 Working Radius Display

6 LED Indicator Lamps

7 Hook Load Display (for winch selected)

8 Winch Select Key

9 LED Indicator Lamps

10 Setup/Cancel Key (used in Calibration Mode)

11 Tare/Enter Key (see Manual for details)

12 Up/Down Key (used in Calibration Mode)

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1. Important Safety Notice

The RCI-4000IS System is a crane device which warns the operator of impending overload conditions and overhoist conditions which could cause damage to property, crane and personnel.

The system is not a substitute for good operator judgement, experience and safe crane operation. The operator is solely responsible for the safe operation of the crane.

The operator must, prior to operation of the crane, read this manual carefully and thoroughly and shall ensure that all operational instructions and warnings are understood and complied with.

Proper system operation requires the operator to correctly program the RCI System to match the crane setup and working configuration.

The system is equipped with an override key which bypasses alarms and motion cut function at which time the system can no longer warn of impending overload and must only be operated strictly in accordance to the crane manufacturer's setup and operation procedures. Operation of this key is for authorised personnel only who shall be solely responsible for its use.

2. General Description

This Manual contains general information, installation, operation, calibration, maintenance and parts information for the RCI-4000IS Rated Capacity Indicator to suit various Offshore Pedestal Cranes working in a hazardous area (Zone 1 or Zone 2).

Section 3 of this Manual covers the operating instructions of the Rated Capacity Indicator.

Refer to drawing DWG 3305 “RCI-4000IS GENERAL ARRANGEMENT FOR TYPICAL HOIST ROPE TENSION SYSTEM” on Section 11.3. of the Manual for an overview of the System.

Section 11.3. covers all applicable drawings. “DWG Numbers”, where applicable in the following Sections, are also provided for quick reference.

The RCI-4000IS is a certified “Intrinsically Safe” system and a fully automatic Rated Capacity Indicator which provides a display of the following functions:

- Safe Working Load (SWL),
- Boom Length,
- Boom Angle,
- Hoist Rope Falls,
- Sea-State,
- Time and Date,
- Boom Tip Height,
- Hook Radius,
- Actual Load,
- Actual Load as a Percentage of SWL,

The RCI-4000IS display also provides the following features:

- Visual and audible alarms on warnings, motion-cut, and two-blocking detection,
- Self-diagnosis and error codes,
- Data-logging,
- Built-in calibration and fault-finding tools,
- Tare facility,
- Units conversion (imperial/metric) facility,
- Anti-two-block (overhoist limit) facility.

3. Operating Instructions

The following sections explain how to operate the RCI-4000IS and make best use of its capabilities.

3.1. Turning On the RCI-4000IS

The RCI-4000IS can be powered by AC or DC supply as follows:

AC Supply:
240 VAC or 110 VAC, ± 10%, 50/60 Hz. This supply must utilise a neutral to earth connection.

DC Supply:
10 – 40 VDC absolute voltage range.

Power supply earth must be connected to the earth terminal strip (located above the relays on the mounting plate in the Control Unit) unless the supply is Extra-low Voltage (ELV), i.e. less than 32 VAC or 115 VDC.

Drawing Reference:
DWG 1020 (Sheet 3 of 10) – "RCI-4000IS Installation, Control Unit Wiring Detail"

The selected power supply may be permanently connected, however for convenience it should be made via an ON/OFF switch or relay. If the Control Unit is located within a hazardous area, the power MUST be supplied via steel wire armoured cable.

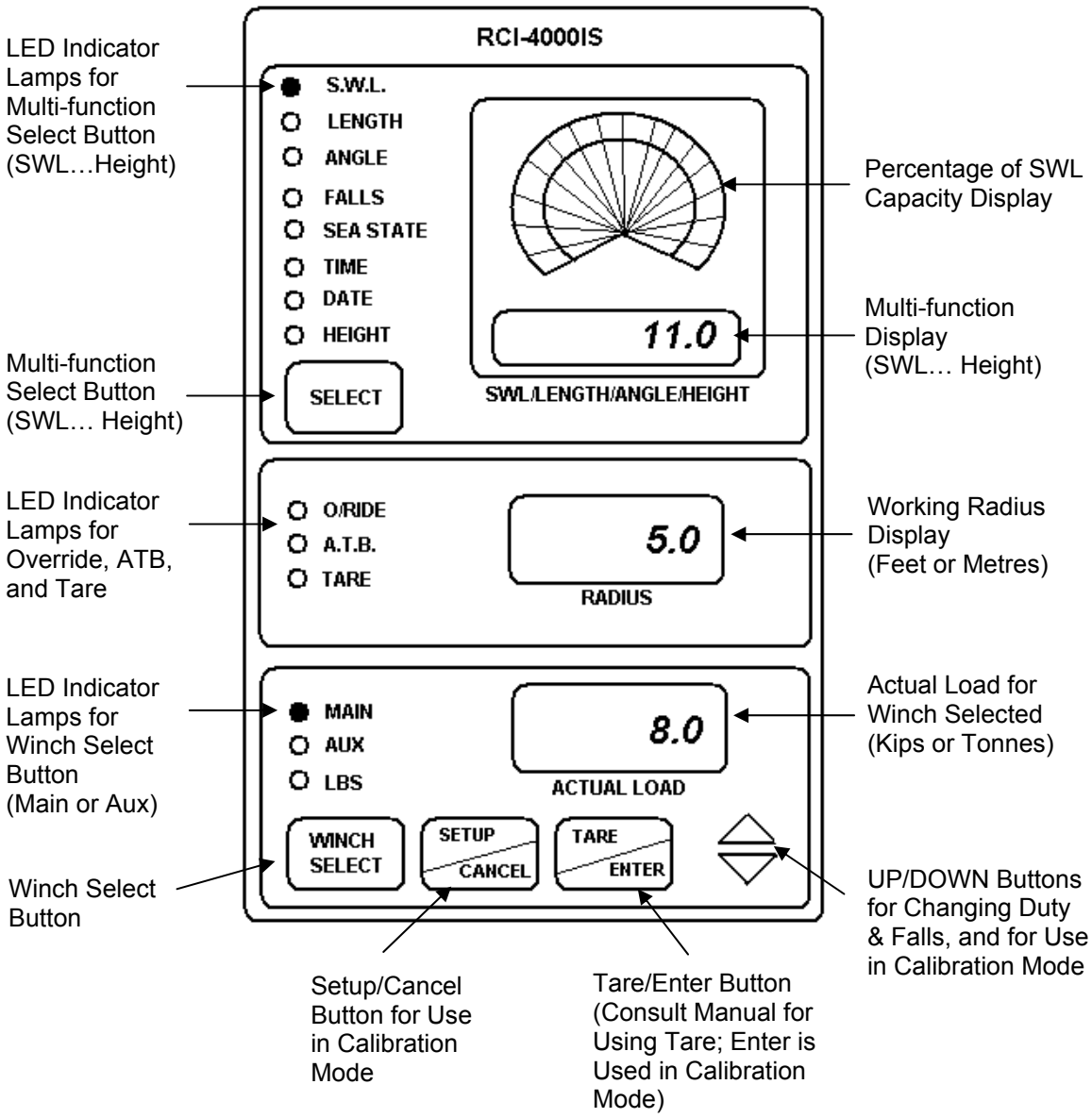
As soon as power is applied to the RCI-4000IS, its display and other indicators should light up and the RCI-4000IS should go through its self-test operation.

3.2. Turning Off the RCI-4000IS

The RCI-4000IS will stop working as soon as the power is removed from it by switching off the supplies indicated in 3.1 above.

3.3. Operating Screen

The following is the operating screen of the RCI-4000IS showing the general display functions:



3.4. Display Functions

The RCI-4000IS has 3 display windows and 6 front panel push buttons. The functions of these are as follows:

TOP DISPLAY WINDOW

This window contains two display areas.

One is an analogue meter used to indicate the percentage of S.W.L. This analogue meter shows the total load as a percentage of the cranes' rated capacity in its current configuration with the aid of a coloured band and pointer. Factory settings are as follows:

- Green: 50 to 84%, Amber: 85 to 99%, Red: 100 to 110%
- Amber section flashes when first trip point is reached (i.e. 85% Rated Capacity) plus an intermittent audible alarm.
- Red section will flash at 100% of rated capacity plus a continuous audible alarm.
- All coloured band segments will flash when the lifted load exceeds 110% of SWL plus a continuous audible alarm. Crane motion controls are also activated at this stage if fitted.

The other area is a numerical display which shows the SWL, LENGTH, ANGLE, FALLS, SEA STATE, TIME/DATE and HEIGHT status.

This window is also used to display ERROR codes when any errors are detected. The error function cannot be manually selected but will be displayed automatically if there are any errors. Please refer to Section 7. “Troubleshooting” for the meaning and description of the error codes.

The above functions are selected by pressing the SELECT button on the front panel. The selected function is indicated by the lamp next to the labels. The display functions are as follows:

SWL

The numerical display shows the current maximum safe working load in unit selected (kilopounds or tonnes). The S.W.L. will depend on the current crane configuration (sea state), winch selected (if twin winch), the maximum linepull and the falls selected.

LENGTH

The numerical display shows the BOOM length, in unit selected (feet or metres), for the winch selected.

ANGLE

The numerical display shows the current working angle in degrees which is read from the main boom angle sensor.

FALLS

The numerical display shows the number of falls *(parts of line)* used for the winch selected.

Prior to crane operation, the operator must ensure that the correct falls is selected to match the actual parts of line on the winch selected.

To change the falls, press the UP/DOWN arrow keys to ramp to the desired falls number while the FALLS indicator is on, and make sure the correct winch is selected.

SEA STATE (DUTY)

The numerical display shows the current sea state (or duty) number which corresponds to the crane charts.

The list of the programmed sea states or duties is provided at the rear of the manual.

Prior to crane operation, the operator must ensure that the correct sea state number is selected to match the actual crane configuration/operation.

To change the sea state, press the UP/DOWN arrow keys to ramp to the desired sea state number while the SEA STATE indicator is on, and make sure the correct sea state is selected.

TIME/DATE

The numerical display shows the current time/date. The time and date functions are also used to time stamp records in the data-logger.

The correct time/date can only be set in calibration mode *(refer to Section 6. "Calibration" for details).*

HEIGHT

The numerical display shows the BOOM tip height (vertical distance between the centre of head sheave of the winch selected to any assigned reference point on the platform). This is calculated from the boom or jib length, angle, and geometry of the winch selected.

Please refer to Section 11.5. “RCI System Crane Configuration Sheets/Duty Listing” at the rear of the manual and check accuracy of the geometry (default values are supplied from the factory) against actual measurements, and change as required. Record all changes on the column “Changed To” for future reference.

Please note also that Function Code FC-67 “Boom Height Offset” on the CRANE CONFIGURATION has not been set from the factory. This is the vertical distance from the BOOM FOOT pin to the platform (required reference point). Ensure that this is measured accurately and set for accurate indication of boom tip HEIGHT.

CENTRE DISPLAY WINDOW

This window shows the current working radius, in unit selected (feet or metres), for the winch selected.

There are also three red LED’s on the left side of this window as follows:

O/RIDE	-	LED ON when over-ride/bypass key is switched on.
A.T.B.	-	LED ON when on two-blocking condition.
TARE	-	LED ON when tare function is active (refer to Tare Function section for details).

BOTTOM DISPLAY WINDOW

This window shows the current load, in unit selected (kilopounds or metric tonnes), on the winch selected.

There are three red LED’s on the left side of this window. The MAIN and AUX LED’s indicate which winch is selected. The LBS LED indicates the units selected. LED ON means Imperial Units (klbs, feet) and LED OFF means Metric Units (tonnes, metres).

Use the WINCH SELECT button to switch between MAIN and AUX winches. For Single Winch cranes, only the MAIN winch is active and the AUX LED is disabled.

Although the RCI-4000IS will always check safe operation for both winches, you should make sure that the correct winch is selected as the winch selection affects the values shown on the displays.

When the ACTUAL LOAD exceeds the SWL for the current crane configuration the RCI-4000IS will activate audible and visual alarms.

If the overload is higher than the SWL % for MOTION CUT OUTPUT, set in calibration mode, the instrument will also activate the motion cut relay, if installed. This will then stop further over-loading of the crane. To bypass or temporarily disable motion cut, the operator must use the over-ride key which should be held by the site-supervisor. When the key is inserted into the display and is turned on the O/RIDE indicator is illuminated as a reminder.

ROBWAY recommends that the over-ride key be switched OFF at all times and the over-ride key be held by the site-supervisor.

TARE FUNCTION

The RCI-4000IS allows the operator to TARE out the weight of accessories not considered part of the load. This is a toggle function which turns on or off depending on its current state.

If the TARE indicator is illuminated then the displayed load is the total weight minus the accessory weight. When TARE is next pressed, the displayed load reverts to the total.

If the TARE indicator is off then the actual load shown in the load window at the time of pressing the TARE button will be stored in the instrument as the tare load.

Please note that when the TARE function is active, the %SWL is still determined by the total load, irrespective of what is currently displayed.

ANTI-TWO-BLOCK (ATB) OR OVERHOIST LIMIT INDICATOR – OPTIONAL ITEM

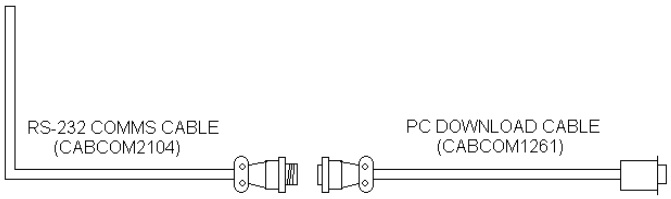
The RCI-4000IS has a standard Anti-Two-Block (ATB) input for connecting an ATB sensor to prevent two-blocking. When the ATB indicator on the front panel is lit, a two-blocking condition has occurred and further hoisting is stopped by activating the motion cut relay, if installed.

This function has been disabled in this system as it is not required. To enable ATB, remove the link/wire across terminals P1 and P2 on the Processor Board terminations and use these terminals for wiring the ATB switch/es (see drawing DWG 1020 Sheet 3 of 10 in Section 11.3. for details).

3.5 Data Logging and Data Downloading

The RS-232 Comms Cable (Part No. CABCOM2104) supplied is to be wired to P15, P16, & P17 in the RCI Control Unit Processor Board Termination (see drawing DWG 1020 Sheet 3 of 10 in Section 11.3 for wiring details).

For downloading data to PC, connect the Data-Logging Download Cable (Part No. CABCOM 1261) between the RS-232 Comms Cable and the PC.



Please refer to Section 11.2. "DATA LOGGING ON ROBWAY RCI's" at the rear of the manual for usage information and details.

<u>Drawing References:</u>
DWG 2104 – "RS-232 Comms Cable"
DWG 1020 (Sheet 3 of 10) – "RCI-4000IS Installation, Control Unit Wiring Detail"

4. Inspection

This section describes the requirements for the three phases of the equipment life, these being:

- Pre-installation,
- Post-installation (pre-commissioning), and
- Post-commissioning.

The requirements are based on AS2381.7 - 1989 "Electrical equipment for explosive atmospheres - Selection, installation and maintenance. Part 7: Intrinsic safety." This manual assumes that the initial selection phase has already been completed and installation is about to commence. These requirements are only applicable to Hazardous Area installations.

4.1. Pre-installation

The following information should be made available to the person(s) responsible for the installation, prior to the time of installation, and should remain available to those responsible for the safe operation of the installation:

1. The zonal classification of areas in which each item of electrical equipment and any interconnecting cables are to be installed.

2. The certificate number of the system.

3. A list of all uncertified items used in the installation. For the RCI-4000 IS system, the only uncertified items are loadcells (purely resistive), simple switches (where applicable) and potentiometer type sensors (purely resistive, where applicable). All these items are classified by the standards as simple apparatus or low energy devices and do not require certification.

4. Details of the cable types used and their electrical parameters. For the RCI-4000 IS system, there are only two cable types specified, these being SWA for the Power and Motion control signals (relays) and instrumentation cable for all other applications. When the cable is supplied as part of the system, use the appropriate cable parameters supplied in the Electrical Parameters section. When the cable is not supplied as part of the system, but is obtained from a third party by the installer/customer/contractor/etc., it is the installer's responsibility to determine the cable parameters. In either case, the parameters listed in the certification documentation must be complied with. Maximum allowable cable length must be checked against the requirements of each installation. In the application where the Control Unit is located in a safe area, the SWA cable may be replaced with a unarmoured equivalent.

5. Refer to any special requirements listed in the certification documentation and note how these requirements will be met in this particular installation. There are only three such requirements for the RCI-4000 IS, these being:

- Installation must be as per the General Arrangement drawings and the cable parameters must not exceed values specified in the certificate. If the cables have been supplied by Robway, then this condition will have been verified by Robway. Should the cable be supplied from a source other than Robway, it is the installer's responsibility to ensure that the cable meets the specified requirements.

- The Display Unit can only be installed in a Gas Group IIB, IIA or safe area, must have a cable length of not more than 10m connecting it to the Control Unit, and must have a cable type with part number 90320R. It is a condition of certification that this cable type ONLY be used between the Control Unit and the Display Unit, therefore it MUST be supplied from Robway.

- The Communication Port must be connected to an item which has certification compatible with the parameters specified in the certificate. Before any item is connected to this port in a hazardous area, permission must be obtained from Robway. Failure to comply may result in an unsafe condition.

6. The approximate physical location on the plant of each item of electrical equipment to be installed, and the proposed routing of any interconnecting cables. Where interconnecting cables cross a zonal boundary, care must be taken to ensure that such a crossing is permitted, and if so, what additional requirements are placed on the cable installation. Refer to the system overview drawing in the rear of the manual for component identification.

7. Any cable identification detail. In general, as the RCI-4000 IS system is so simple, the marking will be restricted to a description of the cable function (e.g. ANGLE). All cables containing I.S. circuits must be identified as such, either by a form of physical marking, or by the use of blue sheathing.

8. The following list shows the area classification, gas group and T class for each item in a RCI-4000 IS system. Check that the proposed installation complies with this list:

Item	Area Classification	Gas Group	T class
Control Unit (Flameproof enclosure)	Class I, Zone 1	IIB	T6
Display Unit	Class I, Zone 1	IIB	T6
Communications Port	Class I, Zone 0	IIC	T6
Load cell	Class I, Zone 0	IIC	T6
Angle sensor	Class I, Zone 0	IIC	T6
Switches	Class I, Zone 0	IIC	T6

Note that any interconnecting cable installed in a Zone 0 area must be provided with additional mechanical protection unless it is SWA.

9. Check the surface temperature class applicable to the flammable material present and compare with the list in 8. above.

10. Inspection check lists against which commissioning and routine inspections should be carried out. Refer to the checklists on Section 4.4. “Inspection and Test Schedule” .

11. Details of electrical testing required at commissioning and inspections. Should there be an operational problem, there may be electrical testing required. Refer to the Trouble shooting section.

12. A record of any modifications and the justification for each modification. If such modifications were present as supplied by Robway, then such a justification will accompany the system. Where these modifications were performed by a party other than Robway, these justifications must be supplied by those responsible for such modifications. Robway takes no responsibility for modifications done to the system that have not been authorised by Robway in written form.

13. Details of any previous inspections. This generally will not be applicable, but is included for the sake of completeness.

14. Check the gas group requirements and compare with the list in 8. above.

4.2. Post-installation

Following the initial installation of the system into a Hazardous Area, the equipment and installation shall undergo a Detailed Inspection to ensure;

1. The suitability for the hazardous area in which it is installed,

2. That it complies with the relevant system documentation, and

3. That no obvious damage has occurred during installation.

Refer to the Detailed Inspection column on Section 4.4. “Inspection and Test Schedule”.

4.3. Post-commissioning

Following commissioning, there are three levels of inspection required by the standard, these being:

4.3.1. Detailed Inspection

A Detailed Inspection should be performed on the equipment and installation at the following times:

- Following commissioning of any new system,

- Following any modification or repair to the system to ensure the continued suitability of the system, and

- Following any change in area classification or process change on a plant to ensure the safety requirements remain valid.

Detailed Inspections should be performed in accordance with the "Detailed" column on Section 4.4. “Inspection and Test Schedule”, and is used to ensure the same level of safety determined by the Post-Installation Inspection.

4.3.2. Periodic Inspection

These inspections must be regular inspections of the equipment and installation to ensure a continuing level of safety. The frequency of inspections should be determined by the person responsible for the safety of the plant, however initially a three (3) month period is recommended. Once a level of confidence has been established, then this interval can be increased. If the interval is increased beyond two (2) years, then Visual Inspections must be performed at intermediate intervals as defined on Section 4.3.3. below. Periodic Inspections should be performed in accordance with the "Periodic" column Section 4.4. “Inspection and Test Schedule”.

4.3.3. Visual Inspection from Floor Level

Where the Periodic Inspection interval exceeds two (2) years, the equipment and installation must be visually inspected in accordance with the "Visual" column in the Inspection and Test Schedule, with an interval which must not exceed half the Periodic Inspection interval.

For all inspections, the results must be recorded.

4.4. Inspection and Test Schedule

	Check that	Detailed	Periodic	Visual
1	System or equipment is appropriate to area classifications	A	A	A
2	Are there any modifications.	A	S	A
3	System group is correct.	A	S	N
4	Equipment temperature class is correct.	A	S	N
5	Equipment or system is clearly marked, and particularly that any equipment or cable labels are legible.	A	S	N
6	Equipment or system carries the correct identification.	A	S	N
7	There are no unauthorised modifications to type and rating of fuses.	A	S	A
8	Relays are of correct type and without damage.	A	A	A
9	Segregation is maintained between Intrinsically Safe and Non-Intrinsically Safe circuits in any junction boxes or similar.	A	A	A
10	Cabling is installed in accordance with the documentation.	A	N	N
11	Cable screens are earthed in accordance with the documentation. This may be difficult when the screens are designed to be terminated within the cable glands.	A	S	N
12	Earthing is according to the documentation.	A	A	A
13	Earth continuity is satisfactory.	A	N	A
14	Electrical connections are tight.	A	S	N
15	Point to point connections are correct.	A	N	N
16	There is no visible damage to equipment or cables and there is no undue accumulation of dust or dirt. Whenever possible, check flame path for signs of damage.	A	A	A
17	Equipment is adequately protected against corrosion, moisture, vibration, excessive temperature, and other adverse factors.	A	A	A
18	Installation is in compliance with the documentation.	A	S	N

*In the above chart, **A**=All, **S**=Sample and **N**=Not required by the standard, but sample is recommended.*

5. Installation

SETTING UP THE CRANE

Lower the crane boom to a safe and convenient position.

INSTALLING BOOM PARTS

Boom Angle Sensor

Fix the angle sensor to the Right Hand Side “inside” the boom (as shown in the photo below) in a convenient position close to the operator's cab. The angle sensor comes complete with a standard mounting plate and kit suitable for simple & fast direct mounting to either the boom butt area or chord/lacings. Photo below shows direct mounting to the butt area where bolts (or fabricated support plate) can be tack-welded (or drilled & tapped). Mount the sensor on the bolts or plate, ensuring that when you look out of the cabin, towards the boom, the angle sensor is vertical and is not tilting to the left or right.

Open the angle sensor enclosure and ensure that the “clinometer” inside the box is in a vertical orientation, with the pivot point at the top when the boom is at 45°. If this is not the case, adjust the clinometer by loosening the screws around it and rotate to correct orientation. Tighten screws once orientation is correct.

Alternatively, the angle sensor can be “clamped” to the chord/lacing closest to the boom butt area by using the universal mounting plate and bolts provided. The position of the angle sensor box on the boom chord can be at an angle (inclined to follow the chord angle), so long as the clinometer inside is adjusted as above.

Route the cable carefully around the boom and boom pivot to the cabin. The angle cable is passed through the Barrier box before terminating into the RCI Control Unit. Fix the cable using adequate straps and fixings ensuring that the cable is not pinched or stretched as the boom moves through its full luffing arc (see also “Cabling – Boom Sensors” item in this Section).

Drawing References:
DWG 2480 – “Dimensional Detail, Certified Angle Sensor”
DWG 1020 (Sheet 3 of 10) – “RCI-4000IS Installation, Control Unit Wiring Detail”

Please note that high tensile booms require proper welding procedure specifications. Obtain specialist assistance in these cases.

Certified angle sensor and typical installation at the boom butt section

HRT Dynamometer (Tensiometer)

This is a three-pulley arrangement load sensor with a beam type loadcell (model RW5000) mounted within. The dynamometer monitors the hoist rope line-pull as the hoist rope passes through the three sheaves. The dynamometer sheaves must be suited to the diameter of the hoist rope. The dynamometer type units are usually rigid mounted on a suitable location on the boom tip section.

Fabricated brackets may be required to attach the dynamometer/s to the boom top and align it to the hoist rope.

For cranes with whip lines, the aux dynamometer may also be mounted on the whip line tip section.

The beam type loadcell inside the dynamometer outputs an electrical signal proportional to the hoist rope line-pull forces which the RCI-4000IS Control Unit then converts into hook-load weight. Correctly following the calibration procedures is essential for accurately determining the hook load weight.

Each hoist rope will require a dynamometer for individual monitoring of Main and Aux hook load.

Route the cable carefully around the boom head, into the Boom lightning protector (Part No. PROLOADT2), along the boom, into the Cabin lightning protector (Part No, PROLOADT2), and into the RCI Control Unit. Fix the cable using adequate straps and fixings ensuring that the cable is not pinched or stretched as the boom moves through its full luffing arc (see also “Cabling – Boom Sensors” item in this Section).

Drawing References:
DWG 0422 (Sheets 1-2 of 2) – “General Arrangement, HRT-3 Dyno”
DWG 1795 – “Dimensional Detail, HRT-4 Dynamometer”
DWG 0796 – “General Arrangement, HRT-4 Dynamometer”

Please note that each load cable will pass through two lightning protector boxes prior to termination into the RCI Control Unit (i.e., there are two lighting protectors per dynamometer). Lightning protectors are mounted in-line with the loadcell cable (see also LIGHTNING PROTECTORS item in this Section for details).

Typical installation of HRT dynamometer

Lightning Protectors (Part No. PROLOADT1 or PROLOADT2)

Part number PROLOADT1 has one lightning protector module for Single Winch cranes, while the PROLOADT2 model has two modules for Twin Winch cranes.

As the name suggests the lightning protector is there to protect the load cell from the effects of lightning. Lightning does not have to strike the crane directly, and can have an effect or even damage the system without a protector if it strikes within a 2 kilometre radius. The energy within a lightning bolt is so great that it can generate sufficiently high voltages in unprotected equipment even at that distance to possibly damage the very sensitive load cell.

The lightning protector printed circuit board should be considered a consumable item and be replaced if suspect. It is not repairable.

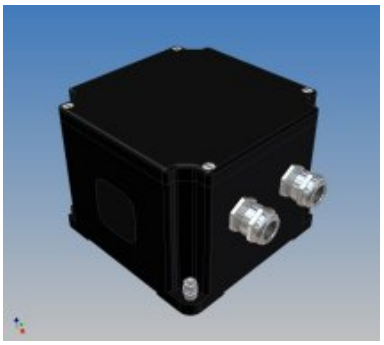
There are two lightning protector modules per dynamometer installed on the crane, one close to the boom head where the dynamometer is mounted and the other inside the cabin close to the RCI Control Unit. Refer to drawing DWG 3305 “RCI-4000IS GENERAL ARRANGEMENT FOR TYPICAL HOIST ROPE TENSION SYSTEM” at the rear of the manual for an overview.

The dynamometer/s at the boom head should be wired in-line with the Boom lightning protector/s and then into the Cabin lightning protector/s before terminating the cable/s inside the RCI Control Unit.

It is imperative that the protectors are connected to the crane chassis as per the general installation drawing at the same place as the item being protected. Following installation, check that there is continuity between the loadcells' screen in the Cabin lightning protector/s and the Control Unit chassis. Also check and ensure that there is no electrical connection between any of the loadcells' conductors and chassis.

Drawing References:

DWG 3089 (Sheet 1 to 3) – "Typical Installation Details, PROLOADT1/T2 Lightning Protector"
DWG 1020 (Sheet 3 of 10) – "RCI-4000IS Installation, Control Unit Wiring Detail"
DWG 1020 (Sheet 9 of 10) – "RCI-4000IS Installation, Data Terminal Wiring"



Lightning Protector (PROLOADT1/T2)

Anti-Two-Block (Optional Item)

Fix the anti-two-block (ATB) switch mounting pin to the main boom head preferably so that the bob-weight (when suspended from the switch) can be fitted to the static hoist rope below the rope anchor. The mounting pin has 2 x 9mm holes. It can either be welded on the boom head section (directly or via a steel plate), or be screwed by drilling and tapping 2 holes on a suitable location on the boom head.

Check that the switch works correctly as the boom luffs throughout its working range. For twin winch cranes, additional switch can be added and mounted at the rooster/aux winch head sheave.

There are two (2) types of bobweight assembly used: universal type (P/N: BOBUNI01) for the main winch, and oval type (P/N: BOBWTWHIP) for the whip line. Please refer to the General Arrangement drawing and related drawings at the rear of the manual for installation details on the bobweights. ***(Note: Cut chain to required length suitable for the winch line speed and application. Loctite threadlocker, or similar, must be applied to all shackles in the ATB assemblies.)***

Fix the ATB cable/s through the junction box/es supplied and route the cable carefully along the boom (or through a boom cable tray, if available) and boom pivot to the cabin. Secure the cable on the boom using adequate straps and fixings ensuring that the cable is not pinched or stretched as the

boom moves through its full luffing arc. Wire the cable into the RCI Control Unit (see drawing DWG 1020 Sheet 3 of 10 in Section 11.3. for wiring details).

Drawing References:

DWG 2934 – "Dimensional Detail, BB5 Anti-Two-Block Switch"
DWG 1020 (Sheet 10 of 10) – "RCI-4000IS Installation, Miscellaneous Wiring Detail (ATB)"
DWG 1020 (Sheet 3 of 10) – "RCI-4000IS Installation, Control Unit Wiring Detail"
DWG 3799 – "Dimensional Detail, ATB Bobweight for Whip Line"
DWG 3819 – "Installation Details, ATB Bobweight for Whip Line"

Please note that high tensile booms require proper welding procedure specifications. Obtain specialist assistance in these cases.

Model BB-5 anti-two-block (ATB) switch and mounting pin

NOTE: It is important to ensure that the hole of the bobweight is kept clean of any dirt or grease as these could stick to the hoist rope and cause false activation of the ATB switch alarm and motion cut (if installed). A periodic inspection of the ATB switch and bobweight is recommended to ensure proper operation of the ATB system.

Cabling (Sensors)

Sensor cables should be fixed firmly to where they are installed and routed along the boom chords (and gantry/A-frame for the force transducer) through to the crane cabin ensuring freedom of movement around the boom pivot pin. Clip cables at approximately 600mm intervals or where suitable to secure them firmly to the boom (and gantry/A-frame for the force transducer).

Stainless steel cable ties are also supplied with the installation kit and to be used where required.

Drawing Reference:

DWG 1047 – "Stainless Steel Cable Tie Tightening Instructions"

INSTALLING CABIN PARTS

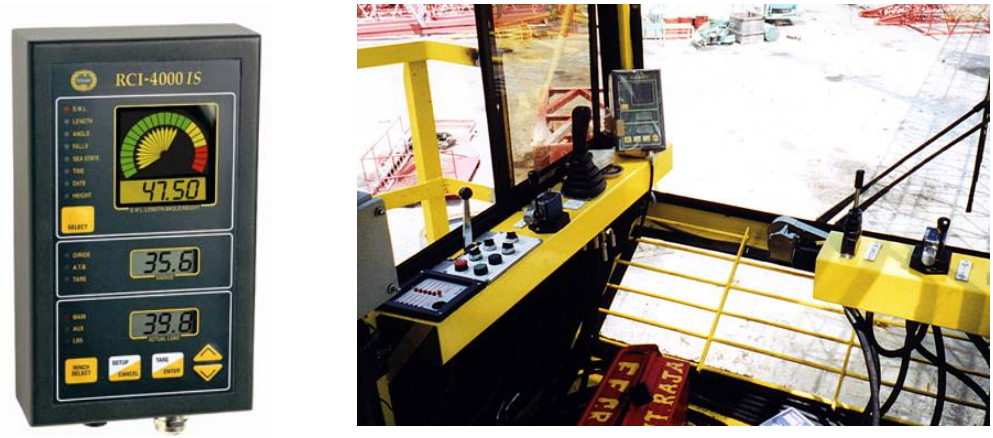
Display Unit

Fit the RCI-4000IS Display Unit in a convenient position in the crane cabin such that the operator can view the displays and reach the push buttons comfortably.

Standard back plate bracket and kit comprising of bolts and nuts are provided. Special bracket may need to be fabricated on site for suitable mounting in the cabin.

Drawing References:
DWG 0705 – "Dimensional Details, RCI-4000IS Display"
DWG 1020 (Sheet 3 of 10) – "RCI-4000IS Installation, Control Unit Wiring Detail"

Check bonding between enclosure and chassis. If a good bond cannot be ensured through the mounting bracket, then install earth strap. It is a condition of installation that equipotential bonding must be ensured between the Display enclosure and the Control Unit enclosure.



Display unit and typical installation inside the cabin

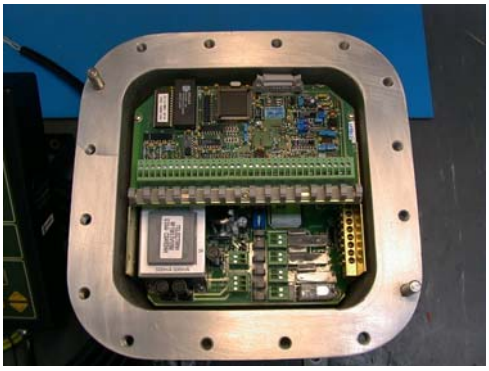
Control Unit

The Control Unit contains the termination points for all modules within the RCI-4000IS system. Terminate all connection cables at the Control Unit. All terminations except power input and relay outputs are intrinsically safe and the appropriate installation precautions must be observed.

The Control Unit is in a flameproof enclosure for hazardous area installation. The power input and relay outputs must be treated as flameproof.

Drawing References:
DWG 0999 – "Enclosure Dimensions, RCI-4000IS Control Unit"
DWG 1020 (Sheet 3 of 10) – "RCI-4000IS Installation, Control Unit Wiring Detail"

Check bonding between enclosure and chassis. If a good bond cannot be ensured through the mounting bracket, then install earth strap. It is a condition of installation that equipotential bonding must be ensured between the Display enclosure and the Control Unit enclosure.



Typical installation of control unit inside the operator's cabin

Cable Glands

The cable glands used on the flameproof Control Unit are barrier glands. Instructions to fit cables & epoxy compound are included with each gland. Once the epoxy has been installed, the gland must not be re-opened as the seal would be broken. If any cable alterations are necessary, then a new barrier gland must be used. The particular glands recommended utilise a unique clamp arrangement which allows either SWA or screen braid to be clamped within the gland. It is important to follow the instructions carefully to use the correct orientation of the clamp to suit the particular cable, and that either the armour (for power and relay cables) or the screen (I.S. cables) is clamped correctly. Do not bring the screen connection through the gland (on I.S. cables) unless the replacement gland is not suitable. In this case the screens must be terminated at the earth terminal block located above the relays on the mounting plate inside the Control Unit.

SWITCH INPUTS

The RCI-4000IS Control Unit has five (5) digital switch inputs to suit specific application and requirement. Input 1 (IP1) is reserved for the optional Anti-Two-Block switch. If ATB is not used, put a shortening link or wire across the IP1 pins.

Refer to the RCI SYSTEM CONFIGURATION SHEET at the rear of the manual for the list of inputs programmed in the software to suit the specific application.

Input Number	Function	Switch Status	Description
IP1 (P1 & P2)	ATB	Closed Open	ATB Safe ATB Alarm
IP2 (P3 & P4)	*Spare*		
IP3 (P5 & P6)	*Spare*		
IP4 (P7 & P8)	*Spare*		
IP5 (P9 & P10)	*Spare*		

RELAY OUTPUTS

The RCI-4000IS Control Unit has two (2) barrier relays and one (1) pcb relay.

Barrier relays RL1 & RL2 are low-power relays with 10W, 40VDC voltage free contact rating and are only used to energise the coils of external high-power SLAVE relays used for activating the Constant Tension function and Automatic Gross Over-moment Protection (AGOP) function.

RL4 is a pcb relay with contact rating of 10A used for activating the Motion Cut (crane lock-out) function.

Below is a summary of the standard function of each relay output. RL2 is a spare relay which can be used for special applications such as Offboard Duty Indicator, Automatic Gross Over-moment Protection (AGOP) activation, External Audible Alarm, etc.

Output Number	Function	Contact Status	Description
RL1 (P6 & P7)	*Spare*	-	Unused
RL2 (P8 & P9)	*Spare*	-	Unused
RL3 (P10 & P11)	Switch Contact for Relay 4 (RL4)	Closed Open	RL4 Coil Energised RL4 Coil De-energised
RL4 (P12 & P13)	Motion Cut (Lock-out)	Closed Open	Motion Cut Inactive - SAFE Motion Cut Active

Drawing References:

DWG 1020 (Sheet 5 of 10) – "RCI-4000IS Installation, Relay Wiring Detail"

DWG 1020 (Sheet 3 of 10) – "RCI-4000IS Installation, Control Unit Wiring Detail"

Please note that all inductive loads such as relays and solenoids require snubber diodes for transient suppression.

6. Calibration

Before any calibration functions can be activated, you must enter CALIBRATION MODE.

Entering Calibration Mode and Selecting Calibration Functions:

- Make sure that the correct duty number (crane configuration) and falls (parts of line) are selected,
- Insert the over-ride key switch into the RCI-4000IS and turn it on, make sure that the O/RIDE indicator on the front panel is lit,
- Press and hold the SETUP button for about 2 seconds,
- The TOP window should show F-xx, where xx is the last calibration function performed or 00 if this is the first time you entered calibration mode,
- Once calibration mode is entered use the UP/DOWN keys to ramp through the calibration functions,
- When the correct function code is shown in the TOP window press the ENTER button to select that function,
- To exit calibration mode either select F-00 or press the CANCEL key until the F-xx code is cleared from the TOP window.

Tools/Items Required for Calibration:

- An accurate angle finder for calibrating boom angle sensor**,**
- An accurate tape meter (at least 100 ft. long) for verifying radius,
- Known test weights for calibrating loads,
- Software configuration sheets and function codes list.

Map of Calibration (Suggested Order):

1. Set year, day/month, and time (FC-32 to FC-34).

2. Verify that raw counts stay within 33-999 for full working range of all sensors (FC-07, FC-15, FC-19).

3. Review all crane geometry against the supplied Crane Configuration settings for correctness (FC-47 to FC-55) – refer also to Section 11.5. "RCI System Crane Configuration Sheets/Duty Listing" at the rear of the manual for factory default settings.

4. Review all SWL % parameters against actual requirements (FC-42 to FC-46) and change if required – refer also to Section 11.5. "RCI System Crane Configuration Sheets/Duty Listing" at the rear of the manual for factory default settings.

5. Review the data logger recording points against actual requirements (FC-65 to FC-71) and change if required – refer also to Section 11.5. "RCI System Crane Configuration Sheets/Duty Listing" at the rear of the manual.

6. Check / Set the following functions:

    - Amplifier gains for load cells as follows:

        - Load Cell 1 (FC-23) – set to 2 mV/V
        - Load Cell 2 (FC-24) – set to 2 mV/V

    - Number of sensor samples to average (FC-27) – set to "8", refer to Section 6.2.20. for details.
    - Metric/Imperial units switching (FC-79) – set to "SI" if not already set. Refer also to Section 6.2.42. for details.

7. Calibrate low & high boom angle sensor (FC-09, FC-10) – refer to Section 6.3. for procedure.

8. Calibrate light and heavy main winch load (FC-02, FC-03) – refer to Section 6.4. for procedure.

9. Calibrate light and heavy aux. winch load (FC-05, FC-06) – refer to Section 6.5. for procedure.

10. Perform functional and operational checks and load tests to ensure accuracy of system.

11. If the load readout decreases as the boom is luffed up, apply load/angle correction factor (FC-72 to FC-75) – refer to Sections 6.2.38. and 6.6. for details and procedure.

12. If required by specific requirement, apply a "winch rigging safe working load" for the main hook (FC-76) and aux hook (FC-77) – refer to Sections 6.2.39. and 6.2.40. for details and procedure.

13. Set the boom height offset on function code (FC-78), if required, to enable correct boom tip height readout. This is the vertical distance from the base of the pedestal to the centre of the boom foot pin. Factory default setting is “0.0m”. Refer also to Section 6.2.41. for details and procedure.

14. Set the maximum boom angle limit required on function code (FC-80). Factory default setting is “82.1 degrees” and can be changed to suit the application. Refer also to Section 6.2.43. for details.

15. Set the rooster (whip line) length required on function code (FC-81). Factory default setting is “0.5 metre” and can be changed to suit actual length. The rooster length is the distance between the centre of the main boom head sheave and the centre of the aux head sheave. Refer also to Section 6.2.44. and Section 11.5. “RCI System Crane Configuration Sheets/Duty Listing” at the rear of the manual for details.

16. Set the rooster (whip line) offset angle required on function code (FC-82). Factory default setting is “30 degrees” and can be changed to suit actual offset measurement. The rooster offset angle is the angle between the rooster (whip line) and the centre line of the main boom. Refer also to Section 6.2.45. and Section 11.5. “RCI System Crane Configuration Sheets/Duty Listing” at the rear of the manual for details.

17. Once satisfied with the calibration results, manually record (pen & paper) the calibration data (FC-40) and all the settings mentioned above. Refer to Section 6.8. “Copying & Restoring Calibration Data Function” for details and procedures.

6.1. Verifying Operation of Sensors

Before you start calibrating the RCI-4000IS, you must make sure that the sensors are working correctly and their signals are reaching the RCI-4000IS.

The RCI-4000IS 'sees' the crane and its surroundings through sensors. The signals from these sensors are represented as numbers inside the RCI-4000IS. The range of possible numbers is 0 to 1023 for each sensor.

The RCI-4000IS allows the user to view both the UNCALIBRATED or the CALIBRATED signal from a given sensor *(refer to the Function Code Listing at the rear of this manual)*.

When viewing the UNCALIBRATED signal from a sensor, make sure the number displayed is less than 999 and is more than 32 as you work the sensor through its working range. This is the correct operating range. Also make sure that the numbers displayed in the window are changing in a nice, smooth manner. If you find that the number is too unstable (i.e. changes by more than 10), then you should check the connections to the RCI-4000IS (refer to Section 7. “Troubleshooting”).

If the signal is less than 32, suspect a short circuit somewhere on that input channel. E.g. the cable to the RCI-4000IS has been crushed and has an internal short circuit in it. Moisture inside the plugs can look like short circuit too.

If the count displayed in the window is 1023, look for an open circuit on that input channel. e.g. disconnected lead.

If the sensors check out then you can continue on and start with the calibration procedure. If you find any problems, check the troubleshooting guide at the end of this manual or seek help from your nearest ROBWAY distributor.

Please note that while in view mode, that is using either "VIEW UNCALIBRATED ..." or "VIEW CALIBRATED ..." functions, the ENTER key works as a toggle switch to turn that channel ON or OFF. This function allows the user to temporarily turn a sensor off if it is not needed. E.g. if you want to use the main winch only on a twin winch system; normally, if you have not connected the auxiliary sensor up, the RCI-4000IS will report an error and activate motion cut. To prevent this you can press the ENTER key, while in "VIEW UNCALIBRATE TRANSDUCER 2 function", to turn the auxiliary channel off.

To turn a channel back on, you have to re-enter the same VIEW UNCALIBRATED... function and press the ENTER key again.

Remember that you must always end a view function by pressing the CANCEL key.

6.2. Configuring User Variables

ROBWAY stores the load-charts, crane geometry, default alarm and motion control settings, default data logging parameters, fine-tuning settings, and other useful user variables in the memory of the RCI-4000IS at the time of manufacture. As this information may vary from crane to crane, even if they are of the same model, the RCI-4000IS allows the installer to change these variables on site. These user variables include dimensions such as slew-offset, maximum falls for main/aux winches, maximum line-pulls, sheave diameters, etc.

The actual values of these variables are printed on a configuration sheet (see Section 11.5. “RCI System Crane Configuration Sheets/Duty Listing” of the manual). A copy of this sheet is also supplied separately with the system.

To verify or change the current value of any of these user variables follow the procedure below:

- Enter calibration mode,
- Select the correct function code from the listing then using the UP/DOWN keys ramp to that function code and press ENTER,
- If you want to change the value use the UP/DOWN key to select the new value then press the ENTER key,
- If you only want to verify the current value press the CANCEL key when finished viewing,
- Now you should be back at the F-xx prompt and can continue on with the next operation.

Please note that the value of these variables is very important as they affect the safe operation of the RCI-4000IS indicator. Therefore the values of the user variables must be checked and corrected if necessary before proceeding with further calibration or operation.

6.2.1 Exit Calibration Mode (FC-00)

Use this function to exit Calibration Mode. Alternatively, exiting calibration mode can also be done by pressing CANCEL button when on a function code other than F-00. Ensure that dashes (----) are shown on the bottom window before pressing CANCEL button to exit.

6.2.2 View Calibrated Main Load (FC-01)

The calibrated Main Winch load can be verified on normal operating mode (operator’s screen). This function is used to view the main calibrated load while still in calibration mode. This is useful when just verifying accuracy of the load readout and the calibration has not yet been finalised.

6.2.3 Calibrate Light Main Load (FC-02)

Please see Section 6.4.1. “Calibrating Light Main Load” for details.

6.2.4 Calibrate Heavy Main Load (FC-03)

Please see Section 6.4.2. “Calibrating Heavy Main Load” for details.

6.2.5 View Calibrated Aux Load (FC-04)

The calibrated Aux Winch load can be verified on normal operating mode (operator’s screen). This function is used to view the aux calibrated load while still in calibration mode. This is useful when just verifying accuracy of the load readout and the calibration has not yet been finalised.

6.2.6 Calibrate Light Aux Load (FC-05)

Please see Section 6.5.1. “Calibrating Light Aux Load” for details.

6.2.7 Calibrate Heavy Aux Load (FC-06)

Please see Section 6.5.2. “Calibrating Heavy Aux Load” for details.

6.2.8 View Uncalibrated Angle Input (FC-07)

Use this function to view the raw counts (or raw data) of the angle sensor. Please also Section 6.1. “Verifying Operation of Sensors” for details.

6.2.9 View Calibrated Angle Input (FC-08)

The calibrated angle can be verified on normal operating mode (operator’s screen). This function is used to view the calibrated angle (in degrees) while still in calibration mode. This is useful when just verifying accuracy of the angle readout and the calibration has not yet been finalised.

6.2.10 Calibrate Low Angle (FC-09)

Please see Section 6.3.1. “Calibrating Low Boom Angle” for details.

6.2.11 Calibrate High Angle (FC-10)

Please see Section 6.3.2. “Calibrating High Boom Angle” for details.

6.2.12 View Uncalibrated Transducer 1 Input (FC-15)

Use this function to view the raw counts (or raw data) of the Main Load transducer (main load sensor). Please also Section 6.1. “Verifying Operation of Sensors” for details.

6.2.13 Function Codes (FC-16 to FC-18) – Not Used

These function codes are used on Load Moment-Based systems only and are not applicable for this crane.

6.2.14 View Uncalibrated Transducer 2 Input (FC-19)

Use this function to view the raw counts (or raw data) of the Aux Load transducer (aux load sensor). Please also Section 6.1. “Verifying Operation of Sensors” for details.

6.2.15 Function Codes (FC-20 to FC-22) – Not Used

These function codes are used on Load Moment-Based systems only and are not applicable for this crane.

6.2.16 Set Gain for Transducer 1 (FC-23)

This function code refers to the mV/V setting of the amplifier and is used to check and/or set the amplifier gain to match the output of the Main Hook load sensor (load pin 1). Correct setting for the “Load Pin” type sensor is 1 mV/V.

6.2.17 Set Gain for Transducer 2 (FC-24)

This function code refers to the mV/V setting of the amplifier and is used to check and/or set the amplifier gain to match the output of the Aux Hook load sensor (load pin 2). Correct setting for the “Load Pin” type sensor is 1 mV/V.

6.2.18 Set Gain for Transducer 3 (FC-25) – For Cranes with Three Winches Only

This function is the same as function codes FC-23 and FC-24 above, but for a third winch if present and if fitted with a load sensor.

6.2.19 Transducer Multiplexer Delay (FC-26)

The multiplexer delay is the setting time (in ms) for the analogue hardware. The default factory setting is “4” and must not be changed.

6.2.20 Number of Sensor Samples to Average (FC-27)

This function is used to stabilise the display in the event that the numbers (readouts during normal operating mode) are changing erratically. This value can be edited by using the Up/Down buttons. Default setting is “0” and the maximum selectable value is “25”.

It is recommended that this value is set to “8” prior to performing calibration.

6.2.21 Function Codes (FC-28 to FC-29) – Not Used

These function codes are used on telescopic cranes only and are not applicable for this crane.

6.2.22 Load Chart View Mode (FC-30)

This function code can be used to view the load charts programmed in the software. It is not part of the calibration or set-up procedures. It is mainly used by Robway for software checking.

6.2.23 View Digital Inputs (FC-31)

This function code is used to view the state (i.e. open or closed) of the 5 digital inputs of the RCI-4000IS. This function is useful when troubleshooting the input signals from the switches to the RCI Control Unit, i.e. if the value changes when the switches are switched on and off.

6.2.24 Set Year (FC-32)

Use this function to set the current year.

6.2.25 Set Day and Month (FC-33)

Use this function to the current day and month.

6.2.26 Set Time (FC-34)

Use this function to set the current time. The time displayed is in the format HH:MM. An invalid time will cause an error message to appear. The seconds can’t be edited and will always be “00” (hidden). The seconds will begin incrementing once the OK button is pressed.

6.2.27 Download Logger Contents to PC (FC-35)

Please see Section 11.2. “Data Logging on Robway RCI’s” at the rear of the manual for details.

6.2.28 Erase Logger Contents (FC-36)

Please see Section 11.2. “Data Logging on Robway RCI’s” at the rear of the manual for details.

6.2.29 Function Codes (FC-37 to FC-39) – Not Used

6.2.30 Alter Calibration Data (FC-40)

This function is used for manually copying and restoring the calibration data which must be done after completing the system calibration. Please see Section 6.10. “Copying & Restoring Calibration Data Function” for details and procedures.

6.2.31 Clear All Calibration Data (FC-41) – USE EXTREME CAUTION!

Activating this function will clear all the calibration data. This must only be used by Robway-trained personnel for troubleshooting purposes.

The display will prompt the operator to press ENTER if he wishes to erase the calibration data. Pressing ENTER here will clean out the memory system and default back to hard coded software. Any on-site changes made will be lost.

6.2.32 User Variables (SWL % Alarms, Motion Cut)

Function codes **(FC-42 to FC-46)** are used to set the Safe Working Load (SWL) percentages for activating Visual and Audible Alarms as well as the Motion Cut output function. The preset or factory default values are based on FFC SLI Specification.

6.2.33 User Variables (Crane Geometry)

Function codes **(FC-47 to FC-55)** are used to set the actual physical dimensions (geometry) of the crane.

The factory default values are based on details and information received at the time of order and supply of system. Any changes to geometry will also require changing of these values on these function codes.

6.2.34 Function Codes (FC-56 to FC-62) – Not Used

6.2.35 Main Winch Contant Line Tensioning Threshold (FC-63)

This function code is used to set the required load limit or threshold of the main winch for activating barrier relay (RL1) in the RCI Control Unit. This function is used to control the crane’s main hoist by activating “hoist up” when the load on the block is equal to or less than the limit set in this function code. The factory default setting is 0.0t and can be changed to suit specific application.

Please see also Section 6.7. “Testing the Constant Tension Function” for details.

6.2.36 Aux Winch Contant Line Tensioning Threshold (FC-64)

This function code is used to set the required load limit or threshold of the aux winch for activating barrier relay (RL1) in the RCI Control Unit. This function is used to control the crane's aux hoist by activating "hoist up" when the load on the block is equal to or less than the limit set in this function code. The factory default setting is 0.0t and can be changed to suit specific application.

Please see also Section 6.7. "Testing the Constant Tension Function" for details.

6.2.37 User Variables (Data Logging Setup Parameters)

Function codes **(FC-65 to FC-71)** are user variables relating to the setup prameters of the internal data logger. Please see also Section 11.2. "Data Logging on Robway RCI's" at the rear of the manual for details.

6.2.38 Load / Angle Correction (FC-72 to FC-75)

Load/Angle correction function is designed for use in cases where the displayed load is seen to increase by a reasonable amount as the boom is luffed down through it's operating range. This phenomenon is particularly apparent when a single sheave tensiometer is used at the boom tip.

Please see Section 6.6. "Using Load/Angle Correction Function" for details and procedure.

6.2.39 Main Winch Rigging SWL (FC-76)

This function is used to set a rigging SWL value for the crane and the boom to get past the maximum radius without activating the alarms. The value set must not exceed the weight of the Main hook block. When this function is used, the crane will assume a SWL equal to the weight of the hook block; thus, allowing the boom to go further down to the ground for rigging purposes without alarms as long as no load is lifted on the Main block.

The factory default setting is 0.0t (or no rigging SWL allowance) and can be changed using this function code to suit specific application.

6.2.40 Auxiliary Winch Rigging SWL (FC-77)

This function is the same as the Main Winch Rigging SWL (refer to Section 6.2.39.) but for the Aux Winch.

The factory default setting is 0.0t (or no rigging SWL allowance) and can be changed using this function code to suit specific application.

6.2.41 Boom Height Offset (FC-78)

Use this function to set the “Boom Height Offset” which is the vertical distance from the base of the pedestal to the centre of the BOOM FOOT pin. Ensure that this is measured accurately and set for accurate indication of boom tip HEIGHT. Factory default setting is 0.0m.

6.2.42 Metric/Imperial Units Switching (FC-79)

Use this function to select the required unit of measure (Metric or Imperial). Factory default setting is “Metric” (“SI” on display).

Press the ENTER button while in this function code to toggle between Metric (“SI” shown on display) and Imperial (“Lbs” shown on display).

6.2.43 Maximum Boom Angle Limit (FC-80)

Use this function to set the “Maximum Boom Angle Limit” required for the application. Once the set limit is reached/exceeded, the audible and visual alarms will be activated. Factory default setting is 82.1 degrees.

6.2.44 Rooster Length (FC-81)

Use this function to set the actual “Rooster Length” or length of the whip line for accurate indication of aux radius. This is measured from the centre of the main boom head sheave to the centre of the rooster (or aux) head sheave. Factory default setting is 0.5m.

6.2.45 Rooster Offset Angle (FC-82)

Use this function to set the actual “Rooster Offset Angle”. This is the angle measured between the rooster and the centre line of the main boom. Factory default setting is 30 degrees.

6.3. Calibrating Boom Angle

6.3.1. Calibrating Low Boom Angle

- Safely luff the boom down to a low angle, e.g. 30°,
- Enter calibration mode, if not already activated, and select the correct function code (FC-09) for calibrating low boom angle,
- Accurately measure the actual boom angle using an angle finder,
- Use the UP/DOWN keys to ramp the display to the required value then press ENTER to accept this value. Proceed to next Section 6.3.2. “Calibrating High Boom Angle”.

6.3.2. Calibrating High Boom Angle

- Safely luff the boom up to a high angle, e.g. 65°,
- Enter calibration mode, if not already activated, and select the correct function code (FC-10) for calibrating high boom angle,
- Accurately measure the actual boom angle using an angle finder,
- Use the UP/DOWN keys to ramp the display to the required value then press ENTER to accept this value.

Verify that the boom angle is accurately measured by using function code (F-08) VIEW BOOM ANGLE. Luff the boom and stop on different boom angle points. Check boom angle with the Angle Finder and verify accuracy against the displayed angle.

6.4. Calibrating Load on the MAIN Winch

6.4.1. Calibrating Light Main Load

- Safely lift a light, known test load off the ground (or platform if offshore), the load should be heavy enough to produce approximately 10% of the maximum main winch linepull,

    - The total weight of any lifting gear or tackle under the hook block (such as slings, lifting frames, etc.) must be added to the weight of the light test load.
    - If a light test load is not available, raise the empty hook block off the ground/platform and use the weight of the block as light load.
    - For some cranes where the hook block is considered part of the crane, raise the empty hook block off the ground/platform and use the value “0.0t” as light load.

- Enter calibration mode, if not already activated, and select the correct function code (FC-02) for calibrating a light load on the main winch,

- Use the UP/DOWN keys to ramp the display to the required value (i.e., calculated light load above),

- Press ENTER to accept value. Proceed to next Section 6.4.2. “Calibrating Heavy Main Load”.

6.4.2. Calibrating Heavy Main Load

- Safely lift a heavy, known test load off the ground (or platform if offshore), the load should be heavy enough to produce approximately 70% of the maximum main winch linepull,

    - The total weight of any lifting gear or tackle under the hook block (such as slings, lifting frames, etc.) must be added to the weight of the heavy test load.
    - For some cranes where the hook block is considered part of the crane, do not include the weight of the hook block to the total heavy load.

- Enter calibration mode, if not already activated, and select the correct function code (FC-03) for calibrating a heavy load on the main winch,

- Use the UP/DOWN keys to ramp the display to the required value (i.e., calculated heavy load above),

- Press ENTER to accept value.

Verify that the MAIN LOAD is accurately measured, using the VIEW CALIBRATED MAIN LOAD (FC-01) function.

6.5. Calibrating Load on the AUX. Winch

6.5.1. Calibrating Light Aux Load

- Safely lift a light, known test load off the ground (or platform if offshore), the load should be heavy enough to produce approximately 10% of the maximum aux winch linepull,

    - The total weight of any lifting gear or tackle under the hook block (such as slings, lifting frames, etc.) must be added to the weight of the light test load.
    - If a light test load is not available, raise the empty hook block off the ground/platform and use the weight of the block as light load.
    - For some cranes where the hook block is considered part of the crane, raise the empty hook block off the ground/platform and use the value “0.0t” as light load.

- Enter calibration mode, if not already activated, and select the correct function code (FC-05) for calibrating a light load on the aux winch,

- Use the UP/DOWN keys to ramp the display to the required value (i.e., calculated light load above),

- Press ENTER to accept value. Proceed to next Section 6.5.2. “Calibrating Heavy Aux Load”.

6.5.2. Calibrating Heavy Aux Load

- Safely lift a heavy, known test load off the ground (or platform if offshore), the load should be heavy enough to produce approximately 70% of the maximum aux winch linepull,

    - The total weight of any lifting gear or tackle under the hook block (such as slings, lifting frames, etc.) must be added to the weight of the heavy test load.
    - For some cranes where the hook block is considered part of the crane, do not include the weight of the hook block to the total heavy load.

- Enter calibration mode, if not already activated, and select the correct function code (FC-06) for calibrating a heavy load on the aux winch,

- Use the UP/DOWN keys to ramp the display to the required value (i.e., calculated heavy load above),

- Press ENTER to accept value.

Verify that the AUX. LOAD is accurately measured, using the VIEW CALIBRATED AUX. LOAD (FC-04) function.

6.6. Using Load/Angle Correction Function

On cranes using single sheave load-line sensors, the rope dead-weight is greatest at low boom angle but disappears at higher angles. This changing dead-weight influence needs to be compensated for as it will cause the load-weight display to increase marginally as the boom is luffed down.

Load/Angle correction is accessible to the Calibrator through use of four Calibration Function Code routines as follows:

Low Angle for Load Correction (FC-72) - Applies to both Main & Aux winch
High Angle for Load correction (FC-73) - Applies to both Main & Aux winch
Load / Angle Correction Factor for Main Winch (FC-74)
Load / Angle Correction Factor for Aux Winch (FC-75)

These function codes allow the operator to enter the luffing range (FC-72 & FC-73) of the crane and a change in the load (FC-74 & FC-75) that is observed over this range.

The *Low Angle* you enter should be the lowest angle the crane can actually luff to in operation. Similarly the *High Angle* should be set to the highest angle the crane can be luffed to.

How to Calculate the Load / Angle Correction Factor
The number entered here is a correction value, when this number is 0.0 no correction is being applied (i.e. Load / Angle correction is disabled). It expresses the *load error (in tonnes)* seen when the crane is luffed from the highest angle in the luff range to the lowest angle. This correction is applied progressively from the highest boom angle through to the lowest boom angle.

To determine the error value simply position the boom at the highest boom angle and take note of the load reading. Luff the boom through the entire operating range (taking notice the load value is increasing when luffing lower) and once at the lowest possible boom angle record the load value again. The correction factor is simply the difference between the two load values you have recorded.

Enter the correction value against the appropriate Function Code **(FC-74 for Main and FC-75 for Aux)** and luff the crane through it's operating range once again to ensure the correction was successful.

Example:
- A test weight of 20 t is lifted on the Main winch at the highest possible boom angle (Note: It is not necessary to use a test weight, the hook block alone will suffice for the test).
- The 20t load is luffed through the entire angle range and the displayed load is seen to rise to 25.3 t at the lowest possible boom angle.
- The error in this reading is the highest displayed load minus the known test weight ie. 25.3 t - 20.0 t = 5.3 t error.
- Hence, in this example, the *Load / Angle Correction Factor* (FC-74) should be entered as 5.3 t.
- Repeat the same procedure on the Aux winch (FC-75).

6.7. Copying and Restoring Calibration Data Function

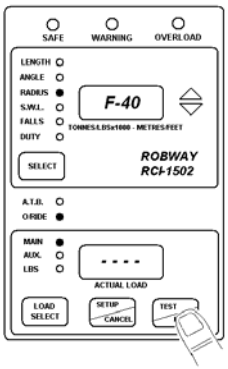
The following procedure covers instructions on how to view and copy the calibration data for service records by accessing function code FC-40 “Alter Calibration Data”.

In any event the system needs to be re-calibrated, for example, due to replacement of parts and/or sensors, these data can be restored into the system simply by keying in the values without the need to luff the boom or lift test loads.

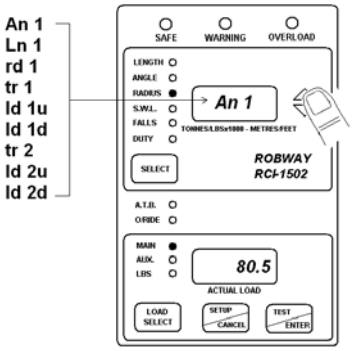
Please note that the following display model illustrated is an RCI-1502, but the procedure remain the same on the RCI-4000IS display.

Procedures in Recording/Copying Calibration Data:

1. Access Calibration Mode.
2. Activate function code **FC-40 (Alter Calibration Data)**.
3. Press ENTER button to select and access the Alter Calibration functions.

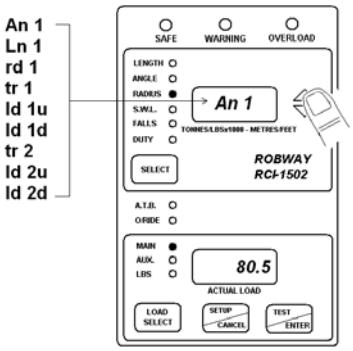


4. Function **An1 (Angle Channel)** will be displayed on top window. An1 is the default item that comes up whenever FC-40 (Alter Calibration Data) is activated.
5. The calibrated value of Angle will be shown on bottom window (e.g., 80.5° as shown in this example).



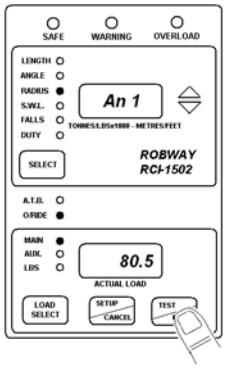
6. Use the Up/Down Arrow keys to go through all the following items listed below.

Codes	Description
An1	**Angle**
Ln1	Boom Length
rd1	Radius
tr1	Transducer 1
ld1u	Load 1 Up
ld1d	**Load 1 Down**
tr2	Transducer 2
ld2u	Load 2 Up
ld2d	**Load 2 Down**
tr3	Transducer 3
ld3u	Load 3 Up
ld3d	Load 3 Down



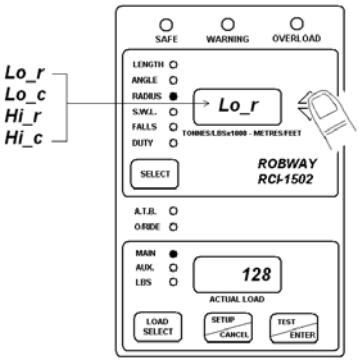
7. Only the “highlighted” items above must be copied. To copy an item, select the item and press the ENTER key.

8. In the example shown, the default item **An1** has been selected.



9. Press ENTER key while on the selected item (e.g. An1) to activate the Edit Codes. There are four (4) Edit Codes as follows:

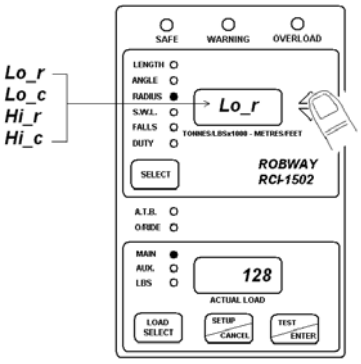
Edit Codes	Description
Lo_r	Raw Counts of Calibrated Data (Low End)
Lo_c	Calibrated Data (Low End)
Hi_r	Raw Counts of Calibrated Data (High End)
Hi_c	Calibrated Data (High End)



10. The first Edit Code is **Lo_r** which refers to the **raw counts or raw data of the calibrated low angle** (e.g., 128 counts as shown in this example).

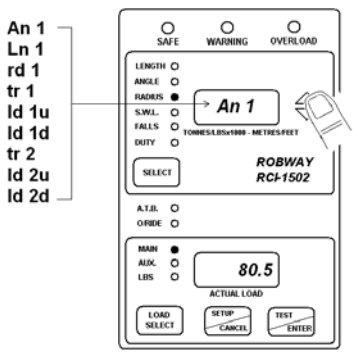
11. Manually record/copy (with pen & paper) the **Lo_r** value.

12. Use the Up/Down Arrow keys to go through and copy the rest of the edit codes (**Lo_c**, **Hi_r**, and **Hi_c**).



13. Press CANCEL key to return to the item **An1** screen.

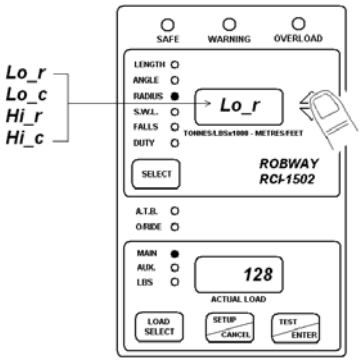
14. Select the next item, **Id1d**, and repeat above procedures 6 to 13. Select and repeat the same on **Id2d** and **Id3d**.



15. Ensure that the Edit Codes for the following items have been recorded/copied before exiting Calibration Mode:

    An1
    Id1d
    Id2d

16. Keep the record for future use (e.g. to re-calibrate the system when calibration data is lost due to faults, or when the Eprom software chip or Dallas memory chip has been replaced with a new one).

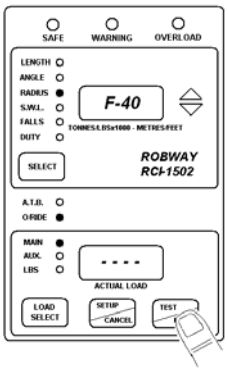


Procedures in Editing & Restoring Calibration Data:

1. Access Calibration Mode.

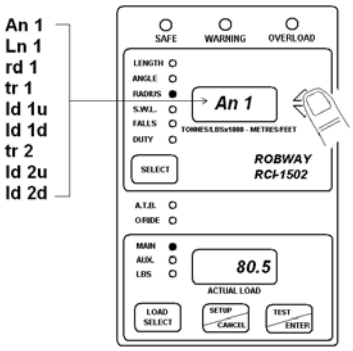
2. Activate function code **FC-40 (Alter Calibration Data)**.

3. Press ENTER button to select and access the Alter Calibration functions.



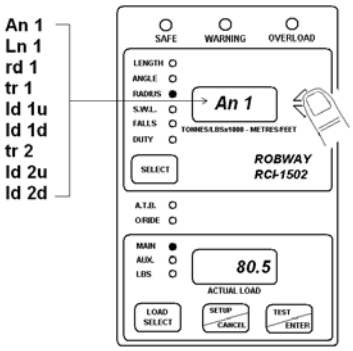
4. Function **An1 (Angle Channel)** will be displayed on top window. **An1** is the default item that comes up whenever FC-40 (Alter Calibration Data) is activated.

5. The calibrated value of Angle will be shown on bottom window (e.g., 80.5° as shown in this example).



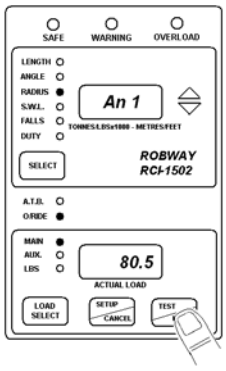
6. Use the Up/Down Arrow keys to go through all the following items listed below:

Codes	Description
An1	**Angle**
Ln1	Boom Length
rd1	Radius
tr1	Transducer 1
ld1u	Load 1 Up
ld1d	**Load 1 Down**
tr2	Transducer 2
ld2u	Load 2 Up
ld2d	**Load 2 Down**
tr3	Transducer 3
ld3u	Load 3 Up
ld3d	Load 3 Down

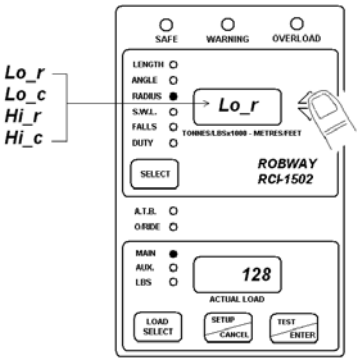


7. Only the “highlighted” items above must be restored. To restore an item, select the item and press the ENTER key.

8. In the example shown, the default item **An1** has been selected. Press the ENTER key while on the selected item (e.g. An1) to activate the Edit Codes.

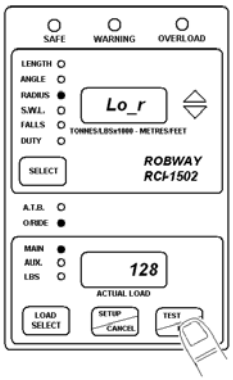


9. Use the Up/Down Arrow keys to go through the list of the four (4) Edit Codes as follows:



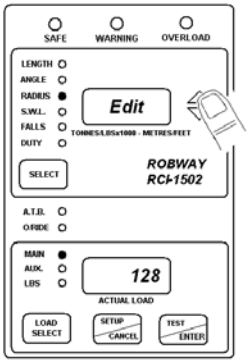
Edit Codes	**Description**
Lo_r	Raw Counts of Calibrated Data (Low End)
Lo_c	Calibrated Data (Low End)
Hi_r	Raw Counts of Calibrated Data (High End)
Hi_c	Calibrated Data (High End)

10. The first Edit Code is **Lo_r** which refers to the **raw counts or raw data of the calibrated low angle** (e.g., 128 counts as shown in this example).

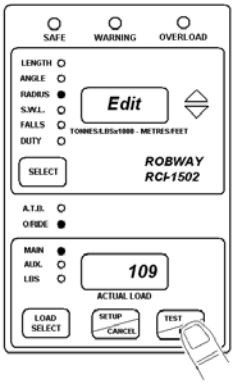


11. Press the ENTER key to access edit mode (i.e. the word “EDIT” comes up on the centre LCD window of the RCI-4000 display).

12. Use the Up/Down Arrow keys to change the **Lo_r** value with the previously copied data.

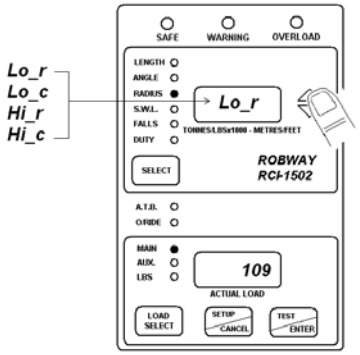


13. Press the ENTER key to store this new value to **Lo_r** (e.g. from 128 to 109 as shown in this example).



14. The screen will then return to the **Lo_r** Edit Code screen.

15. Select the next Edit Code and repeat procedures 9 to 15 until all Edit Codes have been edited (i.e. calibration data have been restored).

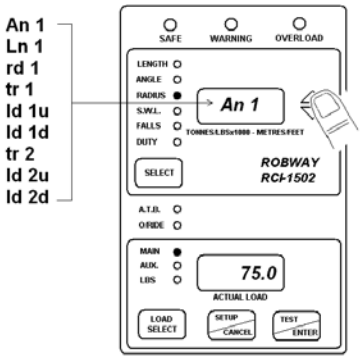


16. Once all of the Edit Codes for **An1** have been edited, press the CANCEL key to return to the **An1** screen.

17. Repeat procedures 6 to 16 until all of the items have been edited.

18. Ensure that all of the following items have been edited before exiting Calibration Mode:

    An1
    ld1d
    ld2d



7. Troubleshooting

A trouble-shooting or fault-finding section is always a difficult document to write because things that are obvious to one person can be anything but obvious to another. On the other hand, most times when you read such a guide the fault you are trying to solve happens to be the very fault that has been left out! The main purpose of this section is to help both us at Robway and you the reader to find the problem and solve it quickly. Some times this takes patience, which isn't always easy when you are on the site, your customer is angry because you haven't fixed it yet, and the Robway guy at the other end of the phone wants you to tell him all over again what you just did!! What we have found many times is that when a situation is described by the service person a couple of times extra details come out in the conversation that are vital to solving the problem. It seems that the more trouble we have finding the faults, the more simple the cause was!

The RCI-4000 IS system incorporates 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. Some notes are provided below, followed by some example faults and possible causes.

1. ***Identify the symptoms.*** Take time to find out exactly what is happening to indicate a 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.

2. ***Leave the calibration alone!*** Too many times a re-calibration has been attempted in order to rectify a problem before that problem has been correctly identified. This leads to added confusion as the perspective is generally moved from the real fault to "calibration problems". We have often received a message indicating that our display has "not accepted the calibration data". Most times this is due to a fault in a cable or sensor which was not identified prior to re-calibration. Re-calibration must only be performed when all physical inputs have been verified for correct operation, and in actual fact is rarely ever needed.

3. ***Do you have your simulator with you?*** A simulator is a very quick way to verify if the fault is external to the display and will save you a lot of heartache. A simulator is purely resistive and hence considered simple apparatus and can be used freely in a hazardous area.

4. ***Have you read the manual?*** When all else fails, read the manual! Your answer may actually be in there.

5. ***Know what information you need to gather.*** If you collect the correct information from the display the job is half done. Before you begin to suspect faults with the system, you must satisfy yourself that the display is correctly configured for the crane environment. In other words, check that the correct duty, falls, slew zones etc. have been selected. Are all of the sensors connected? In general if sensors have been supplied with the system, they must always be 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 be in that situation. If there is still a problem once these have been checked, then you will need to check the hardware.

6. ***The main pieces of useful information*** obtainable from the displays are the **raw counts**. The raw count shows what the actual inputs are doing (i.e. like a signal strength indication). These raw counts are manipulated in software according to the calibration data stored in the display to produce the readouts on the Display Unit. If the calibration has been done incorrectly, or the configuration is incorrect, or something else is wrong, then the Display Unit readouts (e.g. the LOAD or ANGLE values) may provide you with misleading information. **YOU MUST USE THE "VIEW UNCALIBRATED...." FUNCTION CODES TO DETERMINE THE CORRECT OPERATION OF THE EXTERNAL SENSORS, NOT THE "CALIBRATED" VALUES**. It should be noted here that for load related problems, the **"VIEW UNCALIBRATED TRANSDUCER"** function code must be used, and not **"VIEW CALIBRATED LOAD"**. For correct operation these values must be in the range 32 to 999. Anything outside of this range will produce an error. Refer to Section 6. “Calibration” on how to access these raw counts.

7. ***Check the obvious.*** Once you have found a problem with a sensor for example, check all of the obvious things to do with that sensor such as making sure all of the connectors are tight. Be systematic - make notes about what you have done and what you found. You will find that under pressure you can easily forget what you have checked and it becomes very easy to miss things.

EXAMPLE PROBLEMS AND POSSIBLE CAUSES

Problems That Produce Error Codes:

Error code 101.

This is indicating that the signal from the angle sensor is too low or too high. This should be confirmed by viewing the UNCALIBRATED ANGLE INPUT and noting that the value shown in the LOAD display is less than 33, or higher than 999.

Possible causes:

- Angle sensor incorrectly mounted. This is especially critical for the Electronic Angle Sensor. Refer to Section 5. “Installation” of the manual for installation of the angle sensor.
- The angle sensor signal wire is short circuited to the shield or to the angle 0V.
- The angle sensor signal wire is shorted to the excitation positive wire.
- 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.
- The angle sensor excitation voltage is shorted. If this is the case it will also affect the length and load channels.
- The angle sensor 0V wire is open circuit.

Error code 201.

This is indicating that the signal from the main load sensor (load pin 1) is too low or too high. This should be confirmed by viewing the UNCALIBRATED TRANSDUCER 1 INPUT and noting that the value shown in the LOAD display is lower than 33, or higher than 999.

Possible causes:

- Load cell signal wires shorted together.
- The signal + is shorted to the shield.
- The excitation - is shorted to the shield.
- 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 UNCALIBRATED value will generally be non-zero, but below 33.
- The load cell is disconnected or there is an open circuit in one of the signal wires.
- The signal - is connected to the shield.
- The signal + and the excitation + are swapped.
- The signal - and the excitation - are swapped.

Error code 202.

This is indicating that the signal from the auxiliary load sensor (load pin 2) is too low or too high. This should be confirmed by viewing the UNCALIBRATED TRANSDUCER 2 INPUT and noting that the value shown in the LOAD display is lower than 33, or higher than 999.

Possible causes:

- Load cell signal wires shorted together.
- The signal + is shorted to the shield.
- The excitation - is shorted to the shield.
- 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 UNCALIBRATED value will generally be non-zero, but below 33.
- The load cell is disconnected or there is an open circuit in one of the signal wires.
- The signal - is connected to the shield.
- The signal + and the excitation + are swapped.
- The signal - and the excitation - are swapped.

Error code 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 E240 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:

- A genuine overload condition exists.
- It has been caused by another Error code condition.

Error code 280.

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

Possible causes:

- A genuine line pull error exists.

Error code 301.

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

Possible causes:

- A genuine violation of the angle limits has occurred.
- The angle sensor mounting may have loosened allowing the sensor to move.
- Check the angle displayed against the actual angle of the boom.

Error code 304.

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

Possible causes:

- A genuine violation of the radius limits has occurred.
- Check as per Error code 301.

Problems That Do Not Produce Error Codes:

The load does not vary when I lift a weight.

The load cable and/or the load sensor is/are faulty. Check the load cable for faults. If cable is good, check the resistance values of the load cell. This, however, does not give the complete story. Even if the resistances are correct, there is still a chance that a fault on the sensor exists. Replace the load cell.

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

Check the view UNCALIBRATED TRANSDUCER INPUT for that channel. If the values 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 of course there was an error in a load channel while you were calibrating). In other words you forgot to lift the heavy load! (It happens often) In this situation the display is confused because the calibration data is telling it that the signal it is seeing represents both the low load value and the high load value simultaneously. Correct the calibration.

This can also occur if only part of the calibration procedure has been completed. You should expect strange results if you have not completed the calibration of that sensor.

When the system starts in the morning 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.

The display does not start.

Check the power supply. Refer to Section 9. “Electrical Specifications” for the required voltage range. If the supply is within range, open the RCI Control Unit and check the fuses.

On start-up the display shows “LCtrl” on top screen and then hangs (boot up not completed).

- This is a data logger control error. It happens when the internal data logger has been corrupted; when an upgraded or new software has been installed; or when the memory chip (Dallas IC) has been replaced with a new one.
- To fix this error, insert and 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.

8. Maintenance

When maintenance is to be performed on the RCI-4000 IS system, care must be taken to ensure that the level of safety is not reduced. Such a reduction in the level of safety can easily be done by the careless use of tools or test equipment, either directly or by damage to safety components, wiring or clearances. Therefore it is essential that maintenance be performed by competent personnel only.

The following are recommendations from the Standard on maintenance procedures.

8.1. Checklist

It is recommended that a checklist similar to the one below be prepared prior to maintenance.

Maintenance Checklist

Pre-maintenance	Necessary documents are available. All records have been examined. Test gear is available and is satisfactory for use in hazardous areas. Permission to enter or work has been granted. The area is safe to enter. Any precautions necessary have been taken.
Maintenance	All reconnections have been made. Equipment is functional. Malfunctions have been reported. Installation conforms to drawings and documentation. Any modifications have been approved. Area classification is still valid. Earthing requirements are still valid. General check in accordance with the Inspection and Test Schedule completed.
Post-maintenance	Documentation is completed and filed. Inspection report is complete. Company and operator requirements have been satisfied.

8.2. Removal of Electrical Equipment

When any electrical equipment is removed for maintenance, any exposed IS conductors which remain must be mechanically and electrically secured in a manner to prevent the occurrence of an unsafe condition.

8.3. Maintenance Work in Hazardous Areas

When the Control Unit is installed in a hazardous area it is protected by a Flameproof enclosure and must not be opened when a hazard is present. To work on the Control Unit, all power must be removed for at least four (4) minutes before the lid can be removed. Alternatively a gas free permit may be obtained allowing for the removal of the lid while power is still connected. The same constraints apply to the power and motion control cabling as these are not I.S.

Work external to the Control Unit should be restricted to the following:

- Disconnection of, and removal or replacement of, items of electrical equipment and cabling although it is recommended that power be removed from the Control Unit prior to this being done.

- Measurement of various parameters such as loadcell excitation voltage or resistance, or other such maintenance activities. Note, however, that such measurements can ONLY be done with certified test instruments (e.g. Multimeters) otherwise a gas free permit must be obtained. The parameters that may need checking are listed in the Trouble shooting section.

It is important that the person performing the maintenance tasks ensures that the equipment meets the requirements of the relevant documentation on completion.

8.4. Maintenance Work in Non-Hazardous Areas

There are few items in the RCI-4000 IS system that are located in a non-hazardous area, these being;

1. Applications where the Control Unit is located in a safe area and contained within an enclosure other than a flameproof enclosure,

2. Power supply for the Control Unit, and

3. the motion control solenoids or relays.

If any work is required to be done on the above items other than measurements, then the power must be removed from the Control Unit. Measurements made on the IS circuits in the Control Unit must only be made with a certified test instrument if a hazard still exists on the other end of the cables. Failure to do this may cause an ignition source to be transferred into the hazardous area from the test instrument. Care should also be taken to ensure that safety components are not "bypassed" by the test instrument, thus voiding the safety aspect of the Control Unit.

8.5. Modification or Repair

Repairs performed in a hazardous area are specifically discouraged by the Standard. Such repairs should be performed away from the hazardous location.

8.6. Inspection After Maintenance

It is considered essential by the Standard that a Detailed Inspection is performed following any maintenance to ensure that the equipment and installation continue to comply with the documentation.

8.7. Records

The Standard requires that the dates of all inspections, tests and maintenance, and any details of defects found be recorded.

9. Electrical Specifications

9.1. General

Power Supply Input (Either AC or DC)

Nominal 240 VAC to terminals P3 & P4
Range: 176 VAC (220 V-20%) to 288 VAC (240 V +20%), 50/60 Hz

Nominal 120 VAC to terminals P3 & P5
Range: 88 VAC (110 V -20%) to 144 VAC (120 V +20%), 50/60 Hz

DC input to terminals P1 (-ve) & P2 (+ve)
DC supply must be from either of the following sources:
1. Automotive alternator DC supply, nominally 12 V or 24 VDC.
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: 10 VDC - 40 VDC

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

Power Consumption

Approximately 15 VA (W)

Temperature Range:

Storage: -40°C to +60°C (tested to -40°C to +70°C)
Operating: Above -40°C to +60°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: 10 A @ 30 VDC voltage free contact rating. Requires a 12 VDC or 24 VDC 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)

10 W, 40 VDC 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.

9.2. Expected Resistance Values

Load Cell/s

Should have the following nominal resistance values, for a standard 350-Ω cell:

RED-BLACK	300 - 600 Ω
RED-GREEN	200 - 400 Ω
RED - WHITE	200 - 400 Ω
BLACK-GREEN	200 - 400 Ω
BLACK-WHITE	200 - 400 Ω
WHITE-GREEN	350 Ω ± 2 Ω

SHIELD to any other wire must be open circuit

Electronic Boom Angle Sensor

High ohms or open circuit between any of the wires and chassis or shield

9.3. Voltage Levels

Load sensor excitation	4.0 V
Angle excitation	4.0 V
Between the chassis and shield	0 V

9.4. Cable Parameters for Intrumentation Cable Type 90320R

DC Resistance	38 Ω/km
Inductance	277 µH/km
Capacitance	17 nF/km
L/R Ratio	7.29 µH/Ω

10. Appendices

10.1. CERTIFICATIONS

10.2. DATA LOGGING ON ROBWAY RCI's

10.3. DRAWINGS

Appendix 10.1.

Certifications

COMPLIANCE RESOURCE ASSOCIATES INTERNATIONAL
a Joint Venture Business
ABN 25 111 500 773
email: info@cra-international.com.au
Internet: www.cra-international.com.au

ADMINISTRATORS OF THE STANDARDS AUSTRALIA P008 CERTIFICATION SCHEMES FOR EXPLOSION PROTECTED ELECTRICAL EQUIPMENT
ANZEx & AUSEx

Contact : 1300 737 731 www.anzex.com.au admin@anzex.com.au

Robway Crane Safety Systems Pty Ltd
32 West Thebarton Road
THEBARTON SA 5031

Attention: Mr. Jon Koval

01-10-2008

Subject: **Further Extension of Expiry Date for Certificate of Conformity AUSEx_3279X**

Certificate Holder: **Robway Safety Systems**

Dear Sir,

I am pleased to inform you that a further extension of the expiry date of Certificate of Conformity AUSEx_3279X Issue 1 is granted under the authority of the Standards Australia Limited P008 Management Committee for the AUSEx Certification Scheme.

CRA-International understands that a replacement for the product covered by this Certificate of Conformity is being tested and certified by ITACS Australia to the ANZEx Certification Scheme requirements.

I confirm that the expiry date for Issue 1 of this Certificate of Conformity is now the 31-12-2008.

Yours sincerely,

Noel Baker

Associate

CRA-International Pty Ltd

Certification of

EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

Certificate of Conformity

Certificate No: AUS Ex 3279X

Issue 0: Original Issue 24/5/1996
Issue 1: 17/7/1997

Date of Expiry: 24/5/2006

Certificate Holder:
Robway Safety Systems Pty Limited
32 West Thebarton Road
THEBARTON South Australia 5031

Electrical Equipment: Rated Capacity Indicator Model RCI-4000 IS

Type of Protection and Marking Code:

Control Unit (Ex d version)	Display Output:	Ex d(ib) IIB T6(T_{amb}=60)
	Other Outputs:	Ex d(ia) IIB T6(T_{amb}=60)
Control Unit (Safe area version)	Display Output:	Ex (ib) IIB
	Other Outputs:	Ex(ia) IIC
Display Unit:		Ex ib IIB T6(T_{amb}=60)
Remainder of System:		Ex ia IIC T6(T_{amb}=60)

AUS Ex 3279X

Manufactured By:
Robway Safety Systems Pty Limited
32 West Thebarton Road
THEBARTON South Australia 5031

Issued by:

WORKCOVER NEW SOUTH WALES

Londonderry Occupational Safety Centre

132 Londonderry Road LONDONDERRY NSW 2753
Phone: (047) 244 900 Fax: (047) 244 999

QUALITY SYSTEM NAS CERTIFIED AS3902.ISO9002

STANDARDS AUSTRALIA

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EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

Ex 3279X-1

This certificate is granted subject to the conditions as set out in Standards Australia Miscellaneous Publication MP 69 and the Procedures (Doc Q7134) of the scheme.

The electrical equipment and any acceptable variation to it specified in the schedule to this certificate and the identified documents, was found to comply with the following standards:

AS 2380.1-1989 Electrical equipment for explosive atmospheres - Explosion-protection techniques - General requirements
AS 2380.2-1991 Electrical equipment for explosive atmospheres - Explosion-protection techniques - Flameproof enclosure 'd' (incorporating Amendment 1)
AS 2380.7-1987 Electrical Equipment for explosive atmospheres - Explosion-protection techniques - Intrinsic safety 'i'

The equipment listed has successfully met the examination and test requirements as recorded in

Test Report No: LOSC 14518 and Addendum Report 97058217

File Reference: LOSC 95/7653

K.J Finlay
Signed for and on behalf of issuing authority

Coordinator, Approvals Certification
Position

17/7/1997
Date of issue

This certificate and schedule may not be reproduced except in full.

This certificate is not transferable and remains the property of Standards Australia Quality Assurance Services and must be returned in the event of its being revoked or not renewed.

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STANDARDS AUSTRALIA

Certification of
EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

Schedule

Certificate No: AUS Ex 32179X **Issue:** 1 **Date of Issue:** 17/7/1997

Certified Equipment: The Rated Capacity Indicator (Automatic Safe Load Indicator) is intended for use on cranes and other lifting equipment that may be located in a hazardous area. Its primary function is to determine whether the equipment is being operated with the load range. The system makes this determination by measuring the boom angle, length and weight and compares this with certain user configurable 'look up' information.

The system comprises:

a. A power supply and processor board which are located either in a flameproof enclosure or located in a safe area.

b. An intrinsically safe Display Unit which may be located in a hazardous area.

c. A number of intrinsically safe sensors and switches located in the hazardous area.

Conditions of Certification Relating to Original Issue:

1. It is a condition of safe use that the equipment be installed and maintained in accordance with drawing DWG0711 Sheets 1 and 2.

2. It is a condition of safe use that the electrical parameters of the cables connecting the Control Unit to the remote external equipment not exceed the values given in Table 1.

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EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

Addendum to Certificate No. Ex 3279X-1

Conditions of Certification Relating to Original Issue (continued):

Table 1: Allowable Cable Parameters

Gas Group	Angle Sensor	Load Cells	Length Sensor	Switches
Capacitance (μF)				
IIC	2	7	7	7
IIB	16	21	21	21
IIA	51	56	56	56
Inductance (mH)				
IIC	0.05	0.05	0.05	15
IIB	0.15	0.15	0.15	45
IIA	0.40	0.40	0.40	120
L/R Ratio (μH/Ω)				
IIC	20	20	20	317
IIB	60	60	60	951
IIA	160	160	160	2537

3. It is a condition of safe use that the Display Unit only be installed in a Group IIB or a Group IIA hazardous area as shown in drawing DWG0711.

4. It is a condition of manufacture that the Type EJBA886 flameproof enclosure be subjected to a routine pressure test of 1105 kPa in accordance with clause 4.3 of AS 2380.2.

5. It is a condition of safe use that, where operated from a dc supply, the source potential of the dc supply not exceed 100 Vpk, under normal or abnormal conditions.

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Addendum to Certificate No. Ex 3279X-1

Drawings Relating to Original Issue

Drawing No	Drawing Title	Issue	Date
DWG 0695 Shts 1 & 2	Intrinsically Safe Display Board	1.0	8/5/96
DWG 0708 Shts 1 to 3	RCI-4000 IS Processor Board Schematic	1.3	8/5/96
DWG 0711 Sht 1	RCI-4000 IS Functional Block Diagram (Overview)	1.1	16/5/96
DWG 0711 Sht 2	RCI-4000 IS Functional Block Diagram (Typical Application)	1.1	16/5/96
DWG 0711 Sht 3	RCI-4000 IS Functional Block Diagram (Control Unit)	1.1	16/5/96
DWG 0711 Sht 4	RCI-4000 IS Functional Block Diagram (Display Unit)	1.1	16/5/96
DWG 0959 Sht 1	RCI-4000 IS Processor Board (Master Drawing)	3.0	29/4/96
DWG 0959 Sht 2	RCI-4000 IS Processor Board (Silk Screen)	3.0	29/4/96
DWG 0959 Sht 3	RCI-4000 IS Processor Board (Solder Mask)	3.0	29/4/96
DWG 0959 Sht 4	RCI-4000 IS Processor Board (Component Side)	3.0	29/4/96
DWG 0959 Sht 5	RCI-4000 IS Processor Board (Solder Side)	3.0	29/4/96
CIRKIT0959 Shts 1 & 2	RCI-4000 IS Processor	1.2	8/5/96
DWG 0960 Sht 1	RCI-4000 IS Display Board (Master Drawing)	2.0	9/2/96
DWG 0960 Sht 2	RCI-4000 IS Display Board (Silk Screen Component Side)	2.0	9/2/96
DWG 0960 Sht 3	RCI-4000 IS Display Board (Silk Screen Solder Side)	2.0	9/2/96
DWG 0960 Sht 4	RCI-4000 IS Display Board (Solder Mask)	2.0	9/2/96
DWG 0960 Sht 5	RCI-4000 IS Display Board (Component Side)	2.0	9/2/96
DWG 0960 Sht 6	RCI-4000 IS Display Board ((Solder Side)	2.0	9/2/96
CIRKIT 0960	RCI-4000 IS Display	1.1	7/5/96
DWG0969 Shts 1 to 3	RCI-4000IS Power Supply Board Schematic	1.3	29/4/96
DWG 0970 Sht 1	RCI-4000 IS Power Supply Board (Master Drawing)	3.0	29/4/96
DWG 0970 Sht 2	RCI-4000 IS Power Supply Board (Silkscreen)	3.0	29/4/96
DWG 0970 Sht 3	RCI-4000 IS Power Supply Board (Solder Mask)	3.0	29/4/96
DWG 0970 Sht 4	RCI-4000 IS Power Supply Board (Component Side)	3.0	29/4/96
DWG 0970 Sht 5	RCI-4000 IS Power Supply Board (Solder Side)	3.0	29/4/96
CIRKIT0970 Shts 1 & 2	RCI-4000 IS Power Supply	1.1	7/5/96

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Addendum to Certificate No. Ex 3279X-1

Drawings Relating to Original Issue (continued)

Drawing No	Drawing Title	Issue	Date
DWG 0985	RCI-4000 IS Flyback Transformer Assembly Detail	1.0	8/5/96
DWG 1008	RCI-4000 IS Control Unit Assembly Detail	1.3	8/5/96
DWG 1010 Shts 1 & 2	Certified Electronic Angle Sensor Assembly Detail	1.2	13/5/96
DWG1012	RCI-4000 IS Back Light Diffuser Block G.A.	1.0	8/5/96
DWG 1014	RCI-4000 IS Marking Detail	1.2	16/5/96
DWG 1015 Shts 1 & 2	RCI-4000 IS Display Assembly Detail	1.2	13/5/96
DWG1024	RCI-4000 Conformal Coating Detail	1.0	9/5/96
SCO4171851-001	Standard Ratiometric Clinometer With Emi & Esd Protection	A	17/11/95
24-148-GA5	EJBA886 Flameproof & Weatherproof Junction Box	3	12/8/83

Schedule of Variations

Variations Permitted by Issue 1:

1. Optional connection of separately certified equipment to the Communications Port of the Control Unit.
2. Minor changes to component values not affecting the explosion protection properties.
3. A change to a number of drawing to correct typographical errors.
4. Optional earthing of the Display Unit connecting cable screen at both ends.
5. A change to the Conditions of Certification relating to the original equipment.

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Standards Australia Quality Assurance Services Pty Limited A.C.N. 050 611 642

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Addendum to Certificate No. Ex 3279X-1

Additional Conditions of Certification Relating to Variations Permitted by Issue 1:
The Communications Port has been assessed to the 'Entity' Concept and accordingly the following electrical parameters must be taken into account during installation:

Maximum Output Voltage (U_o)	=	15 Volts
Maximum Output Current (I_o)	=	45 milliamperes
Maximum Output Power (P_o)	=	0.22 watts
Maximum External Capacitance (C_o)	=	see Table 2
Maximum External Inductance (L_o)	=	see Table 2
Maximum Input Voltage (U_i)	=	11.4 Volts
Maximum Input Current (I_i)	=	34.8 milliamperes
Maximum Input Power (P_i)	=	0.4 watts
Maximum Internal Capacitance (C_i)	=	0 F
Maximum Internal Inductance (L_i)	=	0 H

Table 2: Summary of Permitted External Capacitance and Inductance

Electrical Partameter	Gas Group		
	IIA	IIB	IIC
Capacitance (μF)	6.4	2.4	0.8
Inductance (mH)	not critical	not critical	100
L/R Ratio (μH/Ω)	not critical	not critical	178

Drawings Relating to Variations Permitted by Issue 1

Drawing No	Drawing Title	Issue	Date
DWG0711 Shts 1 to 4	RCI-4000IS Functional Block Diagram	1.2	27/5/97
CIRKIT0959 Shts 1 & 2	RCI-4000IS Processor Board BOM	1.6	4/7/97
DWG0708 Shts 1 to 3	RCI-4000IS Processor Board Schematic	1.5	1/7/97

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132 Londonderry Road LONDONDERRY NSW 2753
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QUALITY SYSTEM CERTIFIED AS3902.ISO9002

BUREAU VERITAS

Test of RCI-4000 System

Inspection requested by: Favelle Favco Cranes Pty Ltd

Place of Inspection: Robway Safety Systems Pty Ltd
32 West Thebarton Road
Thebarton 5031, South Australia

Date of Inspection: 20 February 1998

1. **Scope of Inspection:**

Witness demonstration of the Safe Load Indicator (PLC) similar to that as used on Favelle-Favco PC200, serial number 939 crane, under the effects of electromagnetic radiation.

2. **Method of Test:**

The Safe Load Indicator comprising the following components:

(a) Control Unit
(b) Display Unit - RCI - 4000IS
(c) Angle Sensor
(d) Load Cell
(e) Lightening Protector

was set up, made operational, and the flicker sensitivity of the display unit noted.

The testing equipment used comprised:

(a) UHF ICOM IC-U16 S/N 01190
TX 480.00 MHz 1 Watt

(b) VHF ICOM IC-H16 S/N 23329
TX 150.00 MHz 0.5 Watt

(c) HF Realistic TRC 208 S/N 135543
TX 27.06m 4 Watt

Head Office : 17 bis, Place des Reflets - La Défense 2 - 92400 Courbevoie - France - Tel. : 33 (1) 42 91 52 91 - Telex : 611135 F

BUREAU VERITAS

(d) Power Meter, Bird Model 612 S/N 88611. Low power scale 0–20 Watt.

(e) Frequency Counter – Dick Smith Electronics. 0–500MHz.

(f) Mobile telephone – Nokia Digital GSM 900MHz.

Each Walkie–Talkie radio was proved against the required watt output and moved around each component within a distance of 50cm. The flicker sensitivity of the display unit was noted.

The mobile telephone was moved around each component within a distance of 50cm and the flicker sensitivity of the display unit noted.

Result of Test:

No evidence of radio or telephone interference was noticed on the Safe Load Indicator (P.L.C.). The indicator continued to operate without glitch (i.e. no malfunction) and all readings on the display unit remained stable.

John A. Powell.

J.A. POWELL
Surveyor

Head Office : 17 bis, Place des Reflets - La Défense 2 - 92400 Courbevoie - France - Tel. : 33(1) 42 91 52 91 - Telex : 611135 F

KEMA
REGISTERED QUALITY

translation

original language: German

(1) EC-TYPE EXAMINATION CERTIFICATE

(2) Equipment or protective system intended for use in potentially explosive atmospheres - Directive 94/9/EC

(3) EC-Type Examination Certificate Number: **KEMA 00ATEX1099 X**

(4) Equipment or protective system: **Überspannungsschutzgerät Typ PLUGTRAB PT 4-EX(I)-24DC-ST und Typ PLUGTRAB PT 2xEX(I)-24DC-ST**

(5) Manufacturer: **Phoenix Contact GmbH & Co.**

(6) Address: **Flachsmarktstraße 8, D-32825 Blomberg, Germany**

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) KEMA, notified body number 0344 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report no. 2004223.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014 : 1997
EN 50284 : 1999
EN 50020 : 1994
EN 50281-1-1 : 1998

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-Type Examination Certificate relates only to the design and construction of the specified equipment or protective system. If applicable, further requirements of this Directive apply to the manufacture and supply of this equipment or protective system.

(12) The marking of the equipment or protective system shall include the following:

Ex II 1 GD T 105...145 °C

EEx ia IIC T4 ... T6

Arnhem, 25 September 2000
by order of the Board of Directors of N.V. KEMA

L.M.J. Vries
Certification Manager

N.V. KEMA
Utrechtseweg 310, 6812 AR Arnhem
P.O. Box 9035, 6800 ET Arnhem, The Netherlands
Telephone +31 26 3 56 27 46, Telefax +31 26 3 51 01 78

ACCREDITED BY
THE DUTCH COUNCIL
FOR ACCREDITATION

KEMA

(13) # SCHEDULE

(14) **to EC-Type Examination Certificate KEMA 00ATEX1099 X**

(15) **Description**

The Surge Voltage Protection Unit Model PLUGTRAB PT 4-EX(I)-24DC-ST and Model PLUGTRAB PT 2xEX(I)-24DC-ST serves to limit eventual surge voltages in intrinsically safe circuits.

Model PLUGTRAB PT 4-EX(I)-24DC-ST is suitable for one circuit and Model PLUGTRAB PT 2xEX(I)-24DC-ST is suitable for two separate circuits.
Several units for different intrinsically safe circuits may be mounted next to each other.

The Units consist out of a fixed mounted part and a plug-in unit provided with a for each Unit Model unique mechanical key.

The fixed mounted Unit is provided with a terminal for connection to ground. Additionally the mounting foot can be connected to ground via a normalized metal mounting rail.

Ambient temperature range (T_a): -40 °C ... +40 °C for temperature class T6
-40 °C ... +55 °C for temperature class T5
-40 °C ... +80 °C for temperature class T4

Electrical data

Typ PLUGTRAB PT 4-EX(I)-24DC-ST

Input circuit ..... (terminals 1, 5, 7 and 11) in type of explosion protection intrinsic safety EEx ia IIC, only for connection to a certified intrinsically safe circuit, with the following maximum values:

U_i	=	30	V
I_i	=	500	mA
P_i	=	3	W

The effective internal capacitance C_i = 1,1 nF.
The effective internal inductance L_i = 1 μH.

Output circuit ..... (terminals 2, 6, 8 and 12) in type of explosion protection intrinsic safety EEx ia IIC. The output data is determined by the input data and has the same values as the ones for the input.

For determination of the applicable maximum allowed external capacitance and inductance also the values of 1,1 nF and 1 μH respectively, shall be taken into account.

KEMA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 00ATEX1099 X**

Typ PLUGTRAB PT 2xEX(I)-24DC-ST

Input circuits ..... (terminals 1 and 5 resp. 7 and 11)	in type of explosion protection intrinsic safety EEx ia IIC, only for connection to a certified intrinsically safe circuit, with the following maximum values:

U_i = 30 V
I_i = 450 mA
P_i = 3 W

The effective internal capacitance C_i = 1,3 nF.
The effective internal inductance L_i = 1 μH.

Output circuits ..... (terminals 2 and 6 resp. 8 and 12)	in type of explosion protection intrinsic safety EEx ia IIC. The output data is determined by the input data and has the same values as the ones for the input.

For determination of the applicable maximum allowed external capacitance and inductance also the values of 1,3 nF and 1 μH respectively, shall be taken into account.

(16) **Report**

KEMA No. 2004223.

(17) **Special conditions for safe use**

1. The Surge Voltage Protection Units shall be installed in an enclosure which as a minimum complies with the below mentioned requirements.

   For application in potentially explosive atmospheres caused by combustible dust the following data and requirements shall be taken into account:

   - The surface temperature of the enclosure is determined by the following relation: $T_{surface}$ = 105 °C + T_a - 40 °C (minimum value 105 °C; maximum value 145 °C), while the dust layer may not exceed a thickness of 5 mm.
   - The mechanical protection of the enclosure shall at least comply with the requirements for IP6X in accordance with EN 60529.
   - The enclosure has to comply with the requirements in accordance with EN 50281-1-1.

   For application in potentially explosive atmospheres caused by flammable gas the following requirements shall be taken into account:

   - The mechanical protection of the enclosure shall, when installed outdoors, at least comply with the requirements for IP4X in accordance with EN 60529.
   - With respect to the materials used, the enclosure shall comply with the requirements of EN 50014 and EN 50284.

2. For the ambient temperature range and the electrical data see (15).

KEMA

(13) **SCHEDULE**

(14) **to EC-Type Examination Certificate KEMA 00ATEX1099 X**

(18) **Essential Health and Safety Requirements**

Essential Health and Safety Requirements not covered by standards listed at (9)	
Clause	Subject
1.0.5	Marking
1.0.6 (b) and (d)	Instructions

These Essential Health and Safety Requirements are examined and positively judged. The results are laid down in the report listed at (16).

(19) **Test documentation**

			signed
1. Description	(2 + 2 pages)		06.06.2000
2. Drawing No.	94 35 919 (2 sheets)	)	07.06.2000
	92 00 775 (2 sheets)	)	
	28 39 253	)	
	0026 2716	)	
	0026 5315	)	
	0026 5393	)	
	0026 8983	)	
	0026 5316	)	15.09.2000
	28 38 225	)	
	0026 2698	)	
	0026 8992	)	
	0026 5295	)	
	0026 5389	)	
	0026 5389	)	
3. Samples			

Appendix 10.2.

Data Logging on RCI Systems

Data Logging on RCI Systems

Introduction

The RCI System Logging occurs automatically whenever the driver lifts a load OR whenever the RCI System detects an error condition on the crane such as moving outside the load chart. The installer has the option to set the percentage of SWL a load must reach before the load will be logged. This *logging percentage* can be set anywhere between 13% and 110% of SWL.

In addition, the installer can configure three *lift counters* which can count the number of lifts performed in three distinct SWL % regions below the *logging percentage*.

Description of Logging Features

Data Logging is stored in a circular arrangement. That is, when the logs are full and another log is performed, the oldest log in the logger will be over-written. Each record stores the following data:

Date	Date log was recorded (dd/mm/yyyy)
Time	Time log was recorded (hh:mm)
Peak Load	Peak load recorded during log cycle
Stable Load	Maximum Stable load recorded during log cycle
Safe Working Load	SWL at operating position
Percent of SWL	Percentage of SWL
Radius	Operating Radius
Error Codes	4 digit *standard Robway Error Codes*
Duty Number	Selected Duty number
Winch selected	Selected winch
Falls reeved	Selected falls
Over-ride state	Off / On indicates whether display was in over-ride

Logging is performed automatically when the percentage of SWL exceeds a threshold value which is set in Function Codes.

When the *logging percentage* is not exceeded while lifting a particular load, the lift occurrence can still be recorded in a *lift counter*. Three separate *lift counters* can be configured to store the number of lifts which occur in a particular SWL % region. Once again, the exact SWL percentages which will be counted can be configured by setting the appropriate Function Codes.

Data Logging on RCI Systems

A summary of the logging percentage Function Codes is displayed in the following table:

Function Code Name	Description	Default Setting
Low Load Lift counter	swl percentage to record	20.0%
Medium Load Lift counter	swl percentage to record	40.0%
High Load Lift counter	swl percentage to record	65.0%
Logging Percentage	swl percentage to log	90.0%

These default settings would give rise to the following logging operation:

Low Load Lift Counter	counts the number of lifts which produce a SWL % which is greater than or equal to 20% but less than 40%.
Medium Load Lift Counter	counts the number of lifts which produce a SWL % which is greater than or equal to 40% but less than 65%.
High Load Lift Counter	counts the number of lifts which produce a SWL % which is greater than or equal to 65% but less than 90%.
Logger	Records full configuration data of any lift which produces a SWL % which is greater than or equal to 90%

Setting Up the Data Logger

Data logging will occur at all times the display is operational. This includes the cases when, the over-ride is activated, the display is reporting an error and during the initial calibration of the system.

For the Logger to operate properly the display must be fully and correctly calibrated. However, since the logger was recording during calibration it is probably desirable to erase the logger contents after completing the angle and load calibrations on the RCI System since the logger would have recorded some invalid information during the calibration of the sensors.

To erase the data logger contents, simply activate the appropriate Function Code once calibration is complete (refer to Function Codes list at the rear of the Manual for the appropriate code).

The operator can access three more Function Codes which control how the actual logging of loads operates. These three Function Codes are summarised in the following table

Stable Load Time	time during which load must stay stable in order to log
Stable Load Variation	load must stay within this variation to be considered stable
Reset Time	load must stay below the Low Load Counter threshold for this time before the log cycle ends

Data Logging on RCI Systems

The first two Function codes in the table are used for determination of a stable load. When a load is hoisted it is probable that the initial load reading will be greater than the actual load on the hook because of the "snatching effect". The stable load is recorded only when these dynamic factors have died down and the load can be considered to be hanging from the hook in a relatively motion free position.

The "Stable load time" and "Stable load variation" Function codes can be used to adjust the load recording to minimise the effect of dynamic factors. The load will be considered stable if the load reading does not change by more than the "Stable load variation" setting (which is 0.1t by default) for a period of time set by "Stable load time" (which is 2 seconds by default).

The third Function code, "Reset time," is used for terminating a lift. When the load causes a SWL % which is less than the logging values (specifically the Low Load Lift counter percentage), then it is assumed that the driver must be putting the load down again. In order to ensure that a single load is not logged multiple times because the SWL % was hovering around the logging threshold, a log cycle will not complete until the load SWL % remains below the threshold for a certain period of time, namely of course the "Reset time" (by default the reset time is set for 5 seconds).

Log Cycle Description

Two types of log cycles are possible:

1. Load is lifted inside load chart boundaries (valid SWL is seen at all times).
2. SWL drops to 0 indicating the load chart has been exceeded, sensor error has occurred or slew error has occurred.

Type 1 Log- Valid SWL cycle

A log cycle is started when:

- the current SWL % (load/swl) exceeds the THRESHOLD (which will be the value set for the Low Load Lift Counter function Code).

During a log cycle:

- the load is monitored, the peak load seen is continually updated and if no stable load has been recorded then all other data is recorded against peak load.
- a stable load condition will apply when the load remains within a small variation range (set by user through F-Code "Stable Load Variation") for a certain period of time (also an F-Code "Stable Load Time").
- when a stable load is seen, all data (except peak load) are recorded against the stable load.

Data Logging on RCI Systems

- load monitoring continues, the SWL percentage is continually checked against the SWL percentage which was stored, if the percentage increases, a new stable load will be recorded.

A log cycle is completed when:

- the current SWL % drops below the THRESHOLD for a period of time set by the Reset Time Function Code

  OR
- the SWL drops to 0 initiating a Type 2 Log cycle.

In either case, the currently performed log will be stored prior to initiating a new cycle.

Type 2 Log- Out of Load Chart / Error conditions

A log cycle is started when:

- SWL drops to 0, implying SWL % is unknown but definitely greater than 110%. In this case the SWL is nominally set to 110% and appears as ">110%" in the logger print out.

During a log cycle:

- the load is monitored and the peak load seen is continually updated (in log 1).
- the radius is monitored and the max. radius seen is continually updated (in log 2).

A log cycle is completed when:

- SWL becomes > 0 (log 1 AND log 2 are stored and condition for starting a type 1 log is checked).

Hence, if a load is lifted within the load chart a single log is performed. If the boom is positioned outside of the load chart, any log cycle in progress is stored and a new cycle begins. During this overload cycle two individual logs will be performed. One log will record the maximum load reading which is observed and the other will record the maximum radius which is observed. It is necessary to perform two logs because it is impossible to know which is a more unsafe condition, a longer radius or a shorter radius but higher load on the hook.

Stable loads are not monitored during out-of-chart/error logging cycles.

Data Logging on RCI Systems

Example Load Lift

Suppose a driver lifts a load and luffs out. If we assume the SWL % generated at the edge of the load chart is sufficient to cause a log to record then as soon as the driver exceeds the maximum radius on the chart, the active log cycle completes and is written to the logger prior to beginning an "out-of-chart" log cycle.

The out-of-chart cycle continues until the driver luffs the crane back into a safe condition. As soon as the safe condition is achieved, the out-of-chart logs (one for max. load and one for max. radius) will be stored to the logger.

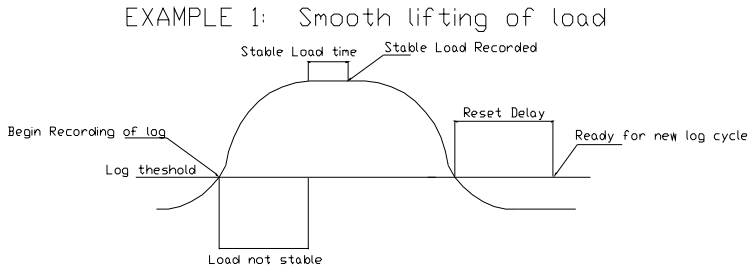
Because the crane is now back in a safe condition, a new logging cycle begins. When the driver finally puts this load down (assuming he does not luff off the chart again) the normal log cycle completes and another log is written to the logger.

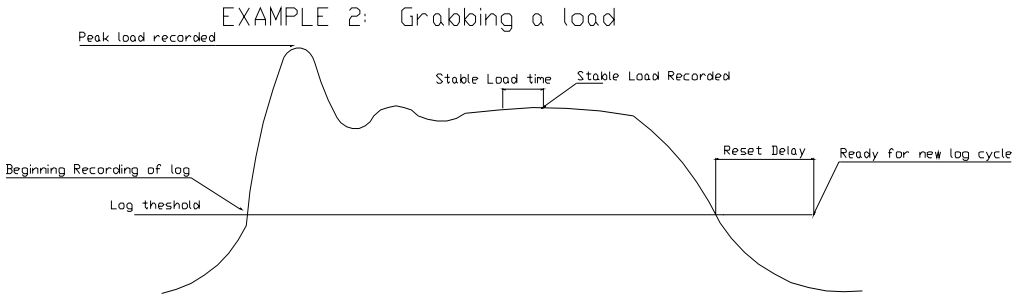
Hence, although the driver has lifted only a single load and luffed it to several positions, the actual load has been recorded a total of 4 times. This example serves to illustrate that if the crane is continually working on it's outer radius, the Logger will fill very quickly.

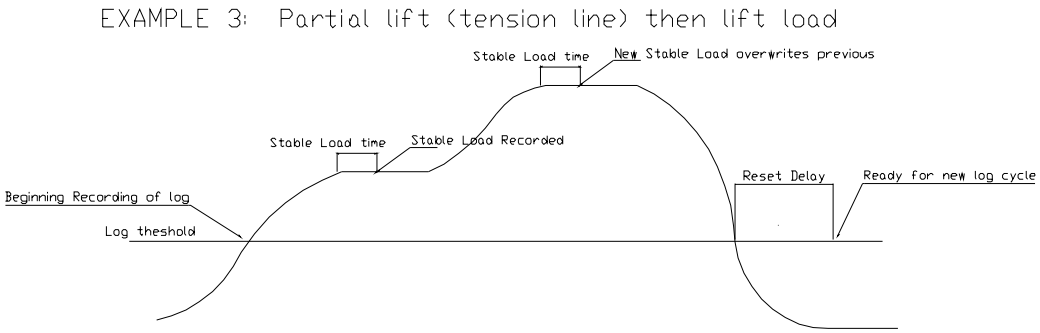
It should be noted that if motion cut is connected and the display is not in over-ride, luffing to the out radius limits of the load chart could cause the crane to oscillate as motion cut activates. In this case many logs may be recorded.

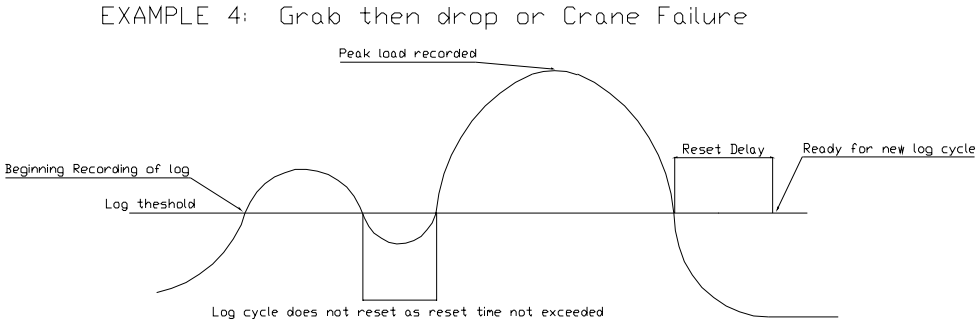
Data Logging on RCI Systems

Example Lift Cycles









Data Logging on RCI Systems

Accessing the Data Logger

When the RCI System is powered on the normal check routines are performed. If your display has logging enabled then the percentage of the logger which is full is displayed on start up in the LOAD window. The display will show the prompt "=LE=" if the logger is completely empty, otherwise the prompt "LXXX" will show where XXX is the percentage of the logger which is currently filled.

The operator can use two more Function codes for accessing the information stored in the data logger. These Function codes are used for:

Downloading the data logger records to a PC, and
Erasing the content of the data logger

Downloading Data Logger Information

Downloading of data logger records can be performed at any time by attaching the cable provided between the RCI System and a standard PC or laptop and selecting the "Download Log Data" Function Code (refer to Function Codes list at the rear of the Manual for the appropriate code).

Communication Settings

The download is performed as an ASCII file transfer which means any standard terminal emulator software (e.g. simterm, procomm, etc.) or the standard Hyper-Terminal program of Windows (98, XP, etc.) could be used to receive the information from the RCI System.

Communication Settings for the transfer are:

Baud Rate	= 9600
Data Bits	= 8
Parity	= none
Stop Bits	= 1

Data Logging on RCI Systems

Downloaded Data Format

Each record will be printed in chronological order followed by a summary on the contents of the data logger. If no records have been stored a message to this extent is displayed on the RCI calibration window however, the summary information is still downloaded to the PC.

The summary consists of 6 lines of information as follows:

1. DOWNLOAD PERFORMED (date time)
2. Percentages Changed (date time) ***
3. No. Lifts in range 20% to 40% SWL = xx
4. No. Lifts in range 40% to 65% SWL = xx
5. No. Lifts in range 65% to 90% SWL = xx
6. No. Lifts logged with > 90% SWL = xx

*** Note: Default date if percentages have not been altered from Robway settings is 01/01/96.

The first line simply states the date and time of when the download was performed.

The second line shows the date and time of when the percentage values for the counters and/or the logging percentage were last changed. The default date displayed is the 01/01/96. If the percentages are changed, the new date and time will be stored. This date and time will be maintained until the values are once again altered or calibration data is cleared.

The third, forth and fifth lines give counts of the total number of lifts performed in the specified regions of SWL %. The percentages shown in this table can of course be changed in Function codes (causing the date in the second line to change as just discussed).

The sixth line gives a count of the number of full logs which have been performed and printed.

The records are printed 1 per line with each field in the record separated by a tab character. This means the resultant file stored on the PC is a tab de-limited text file which is a suitable format for importing into spreadsheet programs such as Microsoft Excel.

Generally spreadsheet programs will automatically recognise the file format as a tab de-limited text file and promptly convert the data into a spread sheet format. In some cases it may prove necessary to ensure the file is saved with a *.txt* extension name which is the standard extension for ASCII text files.

Data Logging on RCI Systems

Downloading of the logger can be performed any number of times without affecting the contents of the logger. Generally however, after downloading is performed, it is normally desirable to erase the contents of the logger.

Downloading takes approximately 15 seconds per 100 records.

Erasing Data Logger Information

Erasing of data logger records can be performed at any time by accessing the Function Code for "Erasing Log Data" (refer to Function Codes list at the rear of the Manual for the appropriate code).

Erasing the data logger will cause all currently recorded logs to be erased (hence the information can no longer be downloaded) and it also clears the SWL % counters.

In effect, the logger is now empty, however, the old records in the data logger have not really been erased, simply the program log counters have been erased. Hence, in the event that the data logger has been erased but the information has not been saved it is possible to have the data extracted from the logger by sending the display to Robway for analysis.

Data Logging on RCI Systems

Errors in Logger Data

On powering the display the contents of the data logger is checked in three separate operations. In 99% of cases these checks will all pass OK. If however a check fails the state of the logger is immediately questionable. Where possible the operator is given the choice of erasing the suspect data, however, in some instances, the logger will automatically be erased.

If you observe an error and have the option to erase the logger contents, we recommend you don't immediately erase the logger if there is desired information stored there, but rather download the data before then erasing.

These errors should not occur except in extenuating circumstances. If you have trouble with log errors you should immediately report such errors to Robway along with the pertinent information about your display (display serial number & software number)

Firstly, the control structure for the data logger is checked. If an error is found in the control structure for any reason, then the display AUTOMATICALLY ERASES data logger contents (because future logging is not reliable). If this error occurs the message:

LOG CONTROL ERR!
RESETTING LOGGER

is displayed in the calibration window. The only way to retrieve any data in the logger in this case is to send the display to Robway for analysis.

Secondly, the actual data in the logger is checked for errors. In the case that the data is found to be suspect then the message:

LOG DATA ERROR!
<ENTER> to ERASE

is displayed in the calibration window. In this event the user is prompted as to whether to erase the logger contents. Ideally the data should be erased since it is not totally reliable however, the choice is presented so as to give the opportunity to download the information prior to erasing the data (note erasing the data also clears the lift counters).

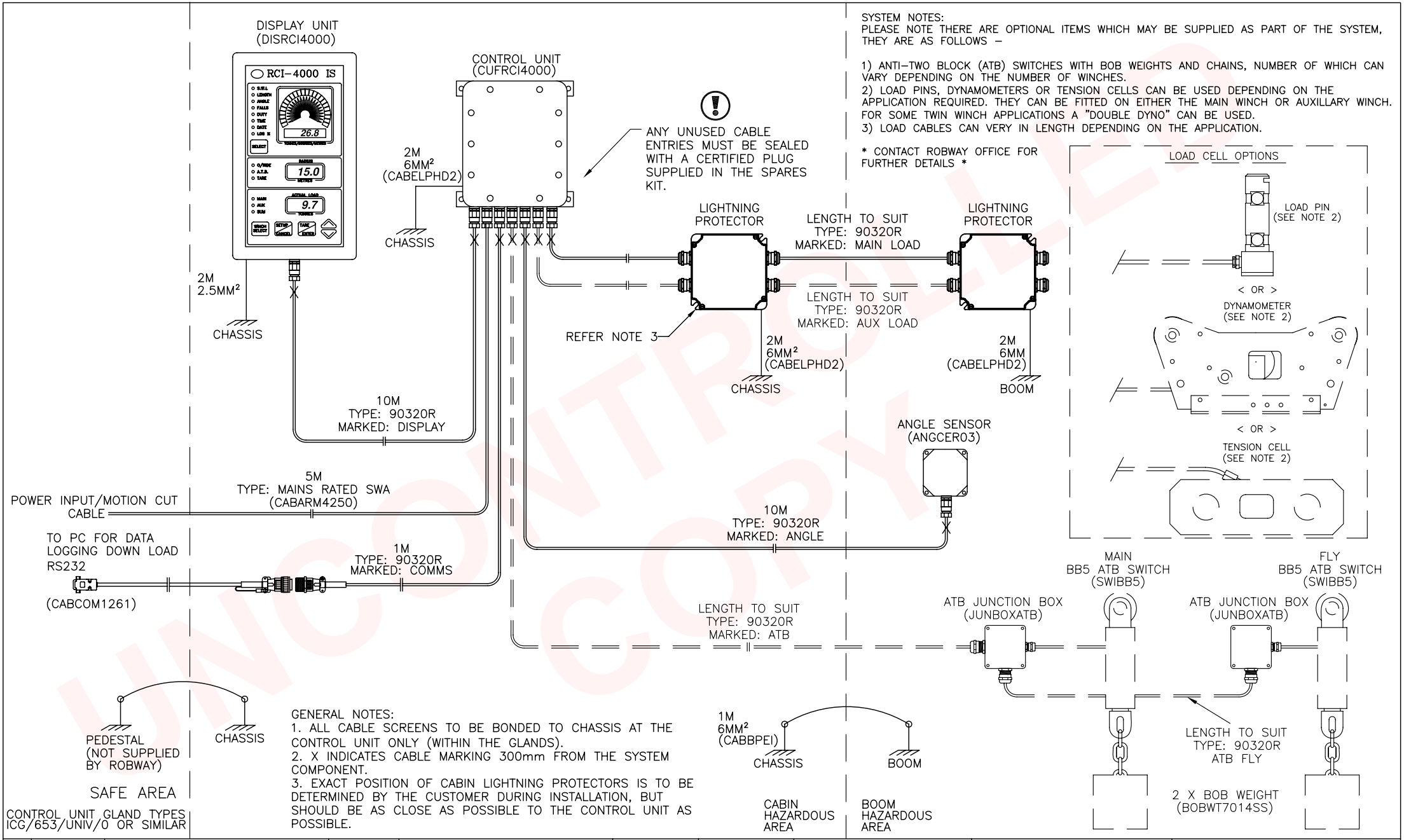
Lastly, the lift counters are checked for errors. Once again, if an error is found the user has the choice of erasing the counts or ignoring the error.

LOG COUNT ERROR!
<ENTER> to ERASE

If the error is ignored, the count values cannot be relied upon as correct.

Appendix 10.3.

Drawings



SYSTEM NOTES:
PLEASE NOTE THERE ARE OPTIONAL ITEMS WHICH MAY BE SUPPLIED AS PART OF THE SYSTEM, THEY ARE AS FOLLOWS –

1) ANTI–TWO BLOCK (ATB) SWITCHES WITH BOB WEIGHTS AND CHAINS, NUMBER OF WHICH CAN VARY DEPENDING ON THE NUMBER OF WINCHES.
2) LOAD PINS, DYNAMOMETERS OR TENSION CELLS CAN BE USED DEPENDING ON THE APPLICATION REQUIRED. THEY CAN BE FITTED ON EITHER THE MAIN WINCH OR AUXILLARY WINCH. FOR SOME TWIN WINCH APPLICATIONS A "DOUBLE DYNO" CAN BE USED.
3) LOAD CABLES CAN VERY IN LENGTH DEPENDING ON THE APPLICATION.

* CONTACT ROBWAY OFFICE FOR FURTHER DETAILS *

GENERAL NOTES:
1. ALL CABLE SCREENS TO BE BONDED TO CHASSIS AT THE CONTROL UNIT ONLY (WITHIN THE GLANDS).
2. X INDICATES CABLE MARKING 300mm FROM THE SYSTEM COMPONENT.
3. EXACT POSITION OF CABIN LIGHTNING PROTECTORS IS TO BE DETERMINED BY THE CUSTOMER DURING INSTALLATION, BUT SHOULD BE AS CLOSE AS POSSIBLE TO THE CONTROL UNIT AS POSSIBLE.

REV	DATE	DESCRIPTION OF CHANGE	APPR'D

TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
S. CHAMBERS	A.CANLAS	–
01/12/05	01/12/05	

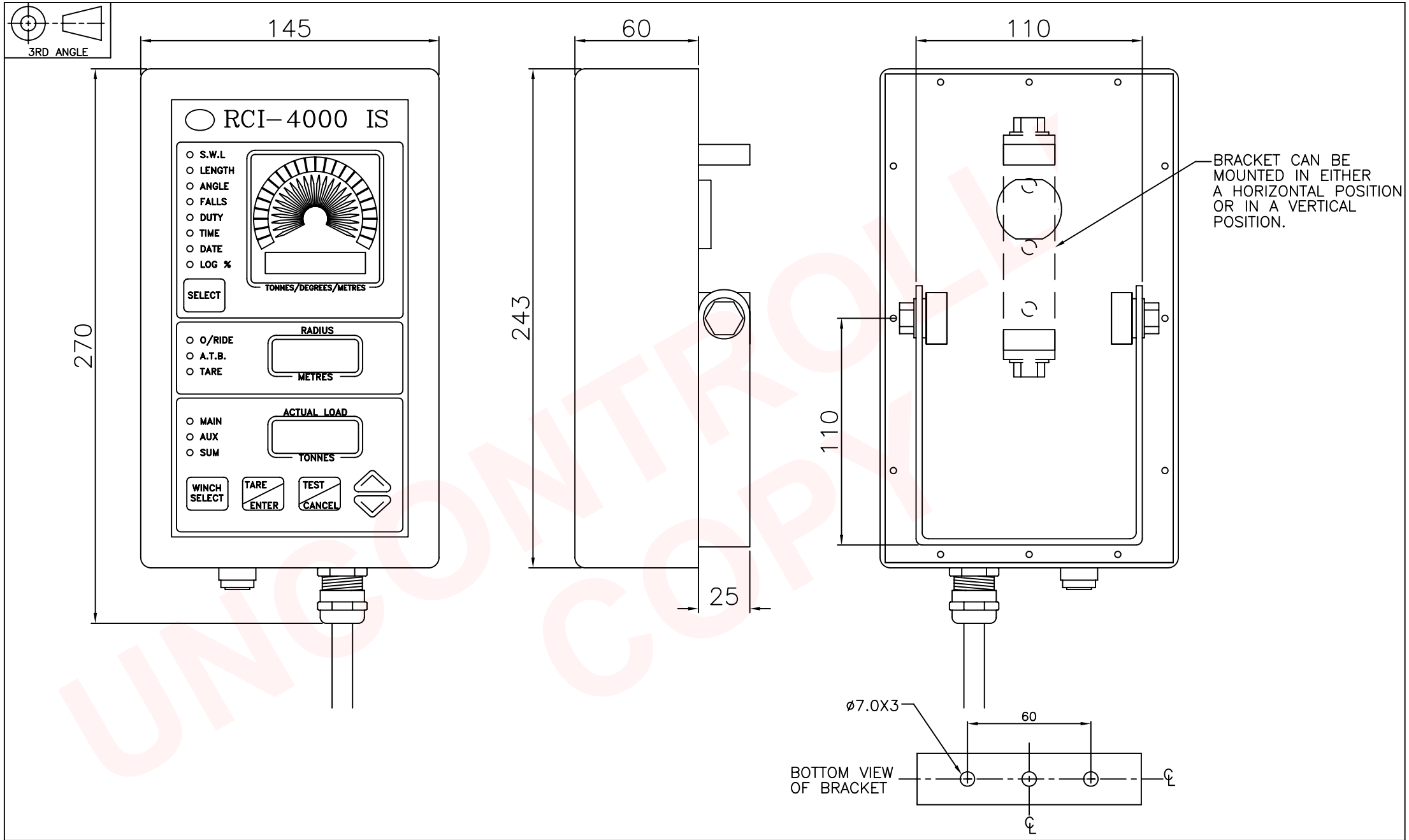
ROBWAY SAFETY SYSTEMS PTY LTD
32 WEST THEBARTON RD
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 352 6055
FAX +61 8 352 1684

CUSTOMER: –
PROJECT: –

TITLE: RCI–4000IS GENERAL ARRANGEMENT FOR TYPICAL HOIST ROPE TENSION SYSTEM

SCALE N/A
SHEET 1 OF 1

DRAWING No: DWG 3305
FILE No: 330501AA.DWG
REV 1.0



REV	DATE	DESCRIPTION OF CHANGE	APPR'D
B	12/03/96	BRACKET DETAIL ADDED	M.T.
1.0	10/11/00	CONVERTED TO AUTOCAD FORMAT	D.P.

TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
M. OBST	M. OBST	–
09/06/95	09/06/95	

ROBWAY SAFETY SYSTEMS PTY LTD
32 WEST THEBARTON RD
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 8352 6055
FAX +61 8 8352 1684

PART No: –

PROJECT: RCI–4000IS DISPLAY

TITLE: DIMENSIONAL DETAILS

SCALE N/A

SHEET 1 OF 1

DRAWING No: DWG 0705

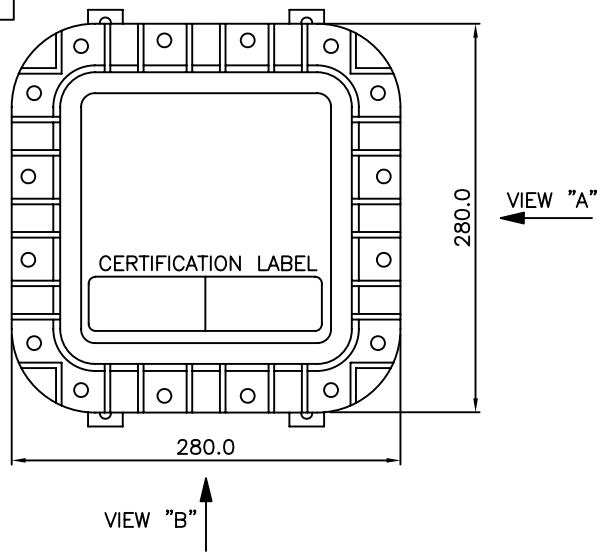
FILE No: 070501AA.DWG

REV 1.0

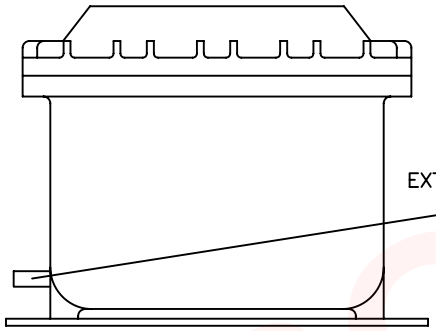
3RD ANGLE

ITEM	QTY	MATERIAL/DESCRIPTION
1	1	FLAME PROOF ENCLOSURE – EJBA 886–ROBWAY

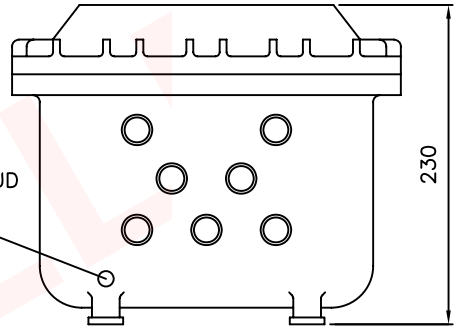
TOP VIEW WITH COVER



VIEW "A"

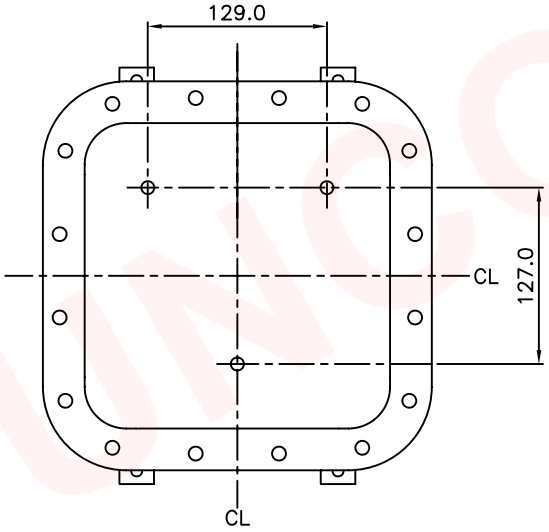


VIEW "B"



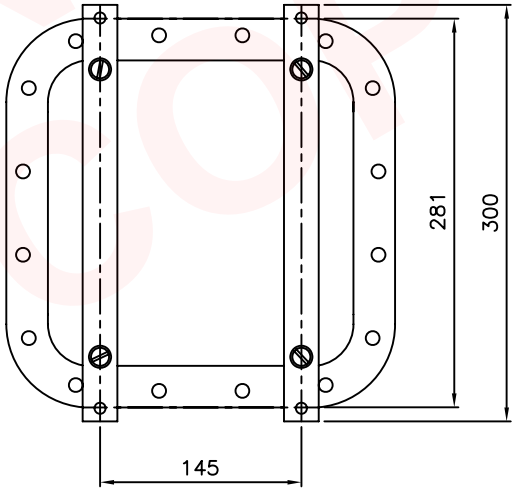
M25 ENTRIES WITH M25 TO M20
BRASS REDUCERS INSTALLED.

TOP VIEW WITHOUT COVER
SHOWING INTERNAL MOUNTING HOLES



HOLES TO BE TAPPED TO 2BA,
11MM DEEP MINIMUM

BOTTOM VIEW



GENERAL NOTES:

1. ENCLOSURE FINISH TO BE LIGHT GREY 2 PACK EPOXY PAINT
2. ENSURE THAT NUT AND BOLT HEAD SIZE ARE THE SAME
3. INCLUDE ONE SPARE BOLT, NUT AND WASHER
4. EXTERNAL EARTH STUD POSITION AS SHOWN
5. ENSURE NO EXCESS COVER MISALIGNMENT
6. NO MOUNTING PLATE REQUIRED.
7. INCLUDE PLASTIC BUNG PLUGS IN GLAND OPENINGS

MOUNTING STRAPS TO BE 25MM x 5MM
316 STAINLESS STEEL
HOLES TO SUIT M8 MOUNTING BOLTS

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	05/07/96	REFER TO DR#169	M.O.
1.2	18/07/96	REFER TO DR#172	M.O.
1.3	30/04/98	REFER TO DR#476	M.O.

TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
M. TURNER	M. OBST	–
19/06/96	19/06/96	

ROBWAY SAFETY SYSTEMS PTY LTD
32 WEST THEBARTON RD
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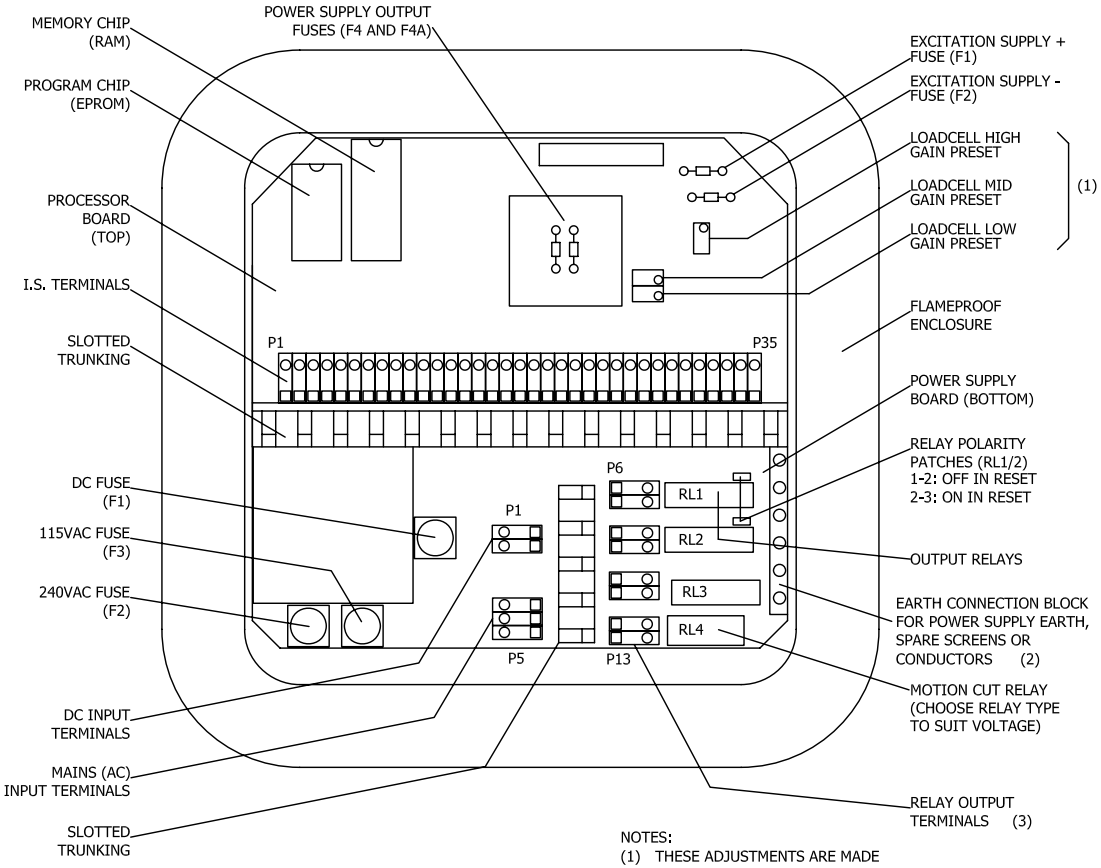
FAX +61 8 352 1684

PART No: ENCEJBA886
PROJECT: RCI–4000IS CONTROL UNIT
TITLE: ENCLOSURE DIMENSIONS
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 0999
FILE No: 099901AD.DWG
REV 1.3

MAN1123A



POWER SUPPLY BOARD TERMINATIONS
(SAFE AREA WIRING - SWA CABLE)

P1	DC SUPPLY INPUT -
P2	DC SUPPLY INPUT +
P3	MAINS (AC) NEUTRAL
P4	MAINS 240VAC INPUT
P5	MAINS 115VAC INPUT
P6	RELAY 1 OUTPUT
P7	RELAY 1 OUTPUT
P8	RELAY 2 OUTPUT
P9	RELAY 2 OUTPUT
P10	RELAY 3 COIL SUPPLY + (12V OR 24V)
P11	RELAY 3 COIL SUPPLY - (0V)
P12	RELAY 4 OUTPUT (MOTION CUT)
P13	RELAY 4 OUTPUT (MOTION CUT)

	PROCESSOR BOARD TERMINATIONS (INTRINSICALLY SAFE WIRING)	WIRE COLOURS (WHERE APPLIC.)
	P1 SWITCH 1 INPUT + (ATB)	
	P2 SWITCH 1 INPUT - (ATB)	
	P3 SWITCH 2 INPUT +	
	P4 SWITCH 2 INPUT -	
LINK	P5 SLEW ENCODER (PROX. SWITCH N/C)	WIRE 5 (SLEW ENCODER)
LINK	P6 SWITCH 3 INPUT -	
	P7 SLEW ENCODER (DIRECTION)	WIRE 3 (SLEW ENCODER)
	P8 SWITCH 4 INPUT -	
	P9 SLEW ENCODER (COUNT)	WIRE 4 (SLEW ENCODER)
	P10 SWITCH 5 INPUT -	
	P11 DISPLAY & SLEW ENCODER +6V SUPPLY	RED (DISPLAY), WIRE 1 (SLEW ENCODER)
	P12 DISPLAY & SLEW ENCODER 0V SUPPLY	BLACK (DISPLAY), WIRE 2 (SLEW ENCODER)
	P13 DISPLAY DATA SIGNAL	GREEN
	P14 DISPLAY CLOCK SIGNAL	WHITE
	P15 RS-232 RXD	WHITE
	P16 RS-232 TXD	GREEN
	P17 RS-232 SIGNAL GROUND	BLACK + RED
	P18 LENGTH EXCITATION +	RED
	P19 LENGTH SIGNAL	WHITE + GREEN
	P20 LENGTH EXCITATION -	BLACK
	P21 ANGLE EXCITATION +	RED
	P22 ANGLE SIGNAL	WHITE + GREEN
	P23 ANGLE EXCITATION -	BLACK
	P24 LOADCELL 1 EXCITATION +	-
	P25 LOADCELL 1 SIGNAL +	-
	P26 LOADCELL 1 SIGNAL -	-
	P27 LOADCELL 1 EXCITATION -	-
	P28 LOADCELL 2 EXCITATION +	-
	P29 LOADCELL 2 SIGNAL +	-
	P30 LOADCELL 2 SIGNAL -	-
	P31 LOADCELL 2 EXCITATION -	-
	P32 LOADCELL 3 EXCITATION +	-
	P33 LOADCELL 3 SIGNAL +	-
	P34 LOADCELL 3 SIGNAL -	-
	P35 LOADCELL 3 EXCITATION -	-

NOTES:

(1) THESE ADJUSTMENTS ARE MADE AT ROBWAY. DO NOT ALTER UNLESS INSTRUCTED BY ROBWAY

(2) POWER SUPPLY EARTH IS REQUIRED UNLESS SUPPLY IS ELV (< 32VAC OR < 115VDC)

(3) REFER TO RELAY CONNECTION DRAWING FOR DETAILS

(4) ALL CABLE SCREENS MUST BE RELIABLY TERMINATED IN THE GLANDS.

USER REPLACEABLE COMPONENT SPECIFICATIONS

POWER SUPPLY FUSES
F1 - 3A/3.15A 250VAC/DC (F) (4000A BREAK CAPACITY)
F2 - 500mA 250VAC/DC (F) (4000A BREAK CAPACITY)
F3 - 500mA 250VAC/DC (F) (4000A BREAK CAPACITY)
F4 - NFR25 1 OHM RESISTORS

PROCESSOR BOARD EXCITATION FUSES
F1 & F2 - WICKMANN 1A 125VAC/DC PICOFUSE

FLAMEPROOF ENCLOSURE (EJBA 886)
COVER BOLT TORQUE - 26Nm
ALLOWABLE FLANGE GAP - 0.15mm (MAX)

MOTION CUT OUTPUT RELAY (RL4)
G2R1-SN (12V) FOR 12V COIL
G2R1-SN (24V) FOR 24V COIL
G2R1-SN (240VAC) FOR 240VAC COIL
G2R1-SN (110VAC) FOR 110VAC COIL

REV	DATE	DESCRIPTION OF CHANGE	APPR'D

TOL: X. +/- 1
X.X +/- 0.2
X.XX AS STATED

DRAFTING STANDARD: AS1100

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED
S. CHAMBERS	
19/11/2008	

PART OF ASSY
—

ROBWAY

web : www.robway.com.au

32 West Thebarton Rd
THEBARTON
SOUTH AUSTRALIA 5031

PH: +61 8 8238 3500
FX: +61 8 8352 1684

PART NO.: ABAN 7 PTE LTD

PROJECT: S/O#97847

TITLE: RCI-4000IS GENERAL ARRANGEMENT FOR LE TORNEAU PCM-120

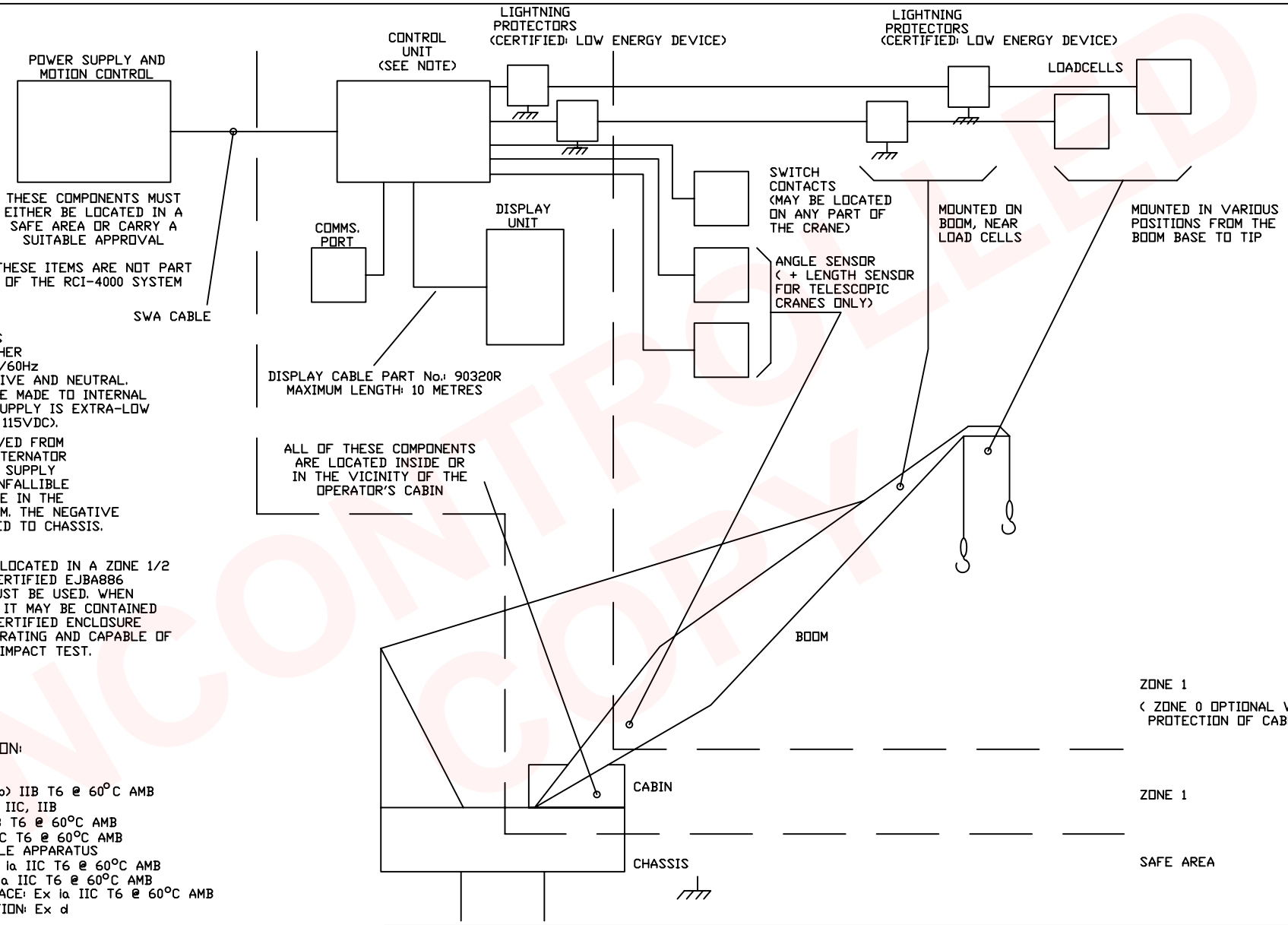
SCALE N/A

SHEET 2 OF 2

DRAWING No: DWG 3932

FILE No: 393201AA.DWG

REV 1.0



POWER SUPPLY REQUIREMENTS

1. MAINS SUPPLY MAY BE EITHER 110V OR 240V +/- 10%, 50/60Hz AND MUST CONSIST OF ACTIVE AND NEUTRAL. EARTH CONNECTION MUST BE MADE TO INTERNAL EARTH TERMINAL UNLESS SUPPLY IS EXTRA-LOW VOLTAGE (< 32VAC OR < 115VDC).
2. DC SUPPLY MUST BE DERIVED FROM EITHER AN AUTOMOTIVE ALTERNATOR SYSTEM OR FROM A POWER SUPPLY CONTAINING A CERTIFIED INFALLIBLE MAINS TRANSFORMER AND BE IN THE RANGE 10V TO 40V MAXIMUM. THE NEGATIVE SUPPLY MUST BE CONNECTED TO CHASSIS.

CONTROL UNIT NOTES

WHEN THE CONTROL UNIT IS LOCATED IN A ZONE 1/2 HAZARDOUS LOCATION, A CERTIFIED EJBA886 FLAMEPROOF ENCLOSURE MUST BE USED. WHEN LOCATED IN A SAFE AREA, IT MAY BE CONTAINED WITHIN ANY SUITABLE UNCERTIFIED ENCLOSURE WITH AN IP54 OR BETTER RATING AND CAPABLE OF WITHSTANDING A 7 JOULE IMPACT TEST.

FORMS OF PROTECTION:

CONTROL UNIT:
- ZONE 1/2 : Ex d (ia,ib) IIB T6 @ 60°C AMB
- SAFE AREA: Ex (ia,ib) IIC, IIB

DISPLAY UNIT: Ex ib IIB T6 @ 60°C AMB
ANGLE SENSOR: Ex ia IIC T6 @ 60°C AMB
BOOM COMPONENTS: SIMPLE APPARATUS
ANALOG INTERFACES: Ex ia IIC T6 @ 60°C AMB
SWITCH INTERFACE: Ex ia IIC T6 @ 60°C AMB
COMMUNICATIONS INTERFACE: Ex ia IIC T6 @ 60°C AMB
POWER SUPPLY CONNECTION: Ex d

GENERAL NOTE:
THE BOOM MUST BE BONDED TO THE CHASSIS. THIS IS NORMALLY DONE THROUGH THE METAL-TO-METAL CONTACT AT THE BOOM PIVOT, HOWEVER IF EQUIPOTENTIAL BONDING CANNOT BE ENSURED BY THIS CONTACT THEN AN ALTERNATIVE MEANS MUST BE USED. THE SAME ALSO APPLIES TO THE BONDING BETWEEN MACHINERY DECK AND PEDESTAL.

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.2	18-11-97	REFER DR#316	M.O.
1.3	21-11-97	REFER DR#395	M.O.
1.4	12-12-97	REFER DR#403	M.O.
1.5	23-02-98	REFER DR#424	M.O.
1.6	17/06/99	REFER DR#659	A.C.
1.7	16/01/03	REFER PR#115	A.C.

	SIGN	DATE
DRAWN	M. OBST	18-4-96
SIGN	M. OBST	3-6-96

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32 WEST THEBARTON RD
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 352 6055
FAX +61 8 352 1684

PART No:

PROJECT:

TITLE:
RCI-4000 IS INSTALLATION (OVERVIEW)
(COPY OF DWG0711 SHT 1)

SCALE N/A

SHEET 1 OF10

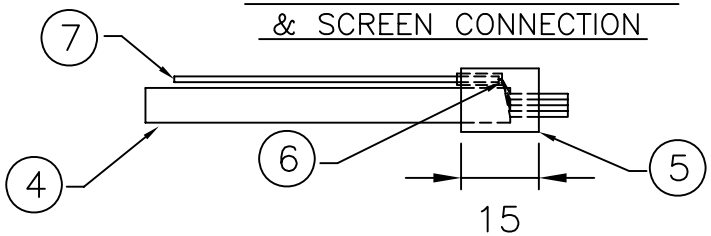
DRAWING No: DWG1020

FILE No: 102001AH.DWG

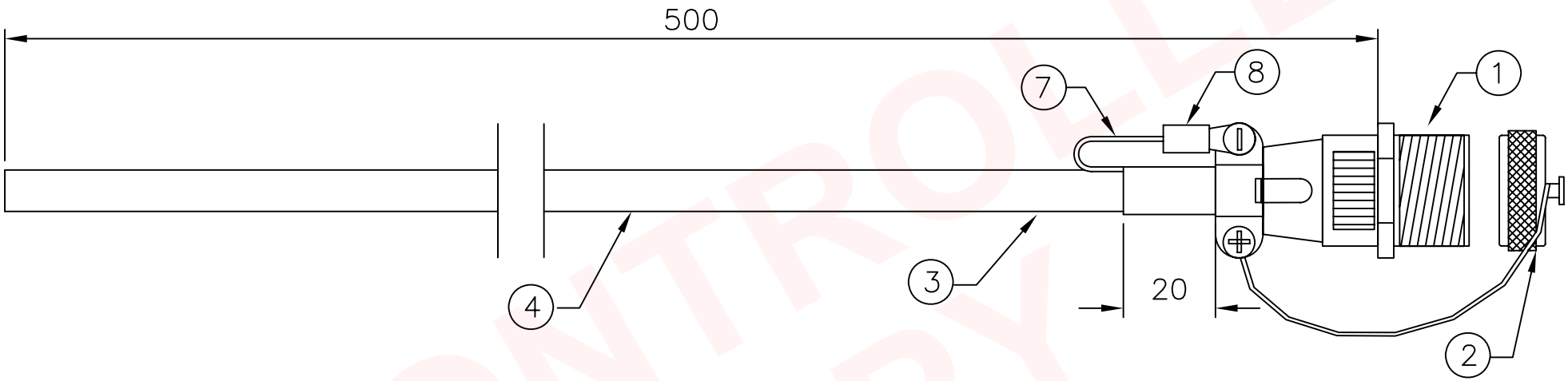
REV 1.7

3RD ANGLE

EXPLODED VIEW OF PIGTAIL & SCREEN CONNECTION



ITEM	QTY	MATERIAL/DESCRIPTION	DWG No.	STOCK CODE
1	1	7 WAY SOCKET	–	SOCKIL7W
2	1	DUST CAP	–	CAPMS03
3	1	7 WAY BOOT	–	BOOT7P
4	0.5M	4 CORE SCREENED CABLE (10MM)	–	CABBSHLD4C10
5	0.015M	HEAT SHRINK	–	HEAS38B
6	0.010M	HEAT SHRINK	–	HEAS116B
7	0.06M	GREEN/YELLOW CABLE 24/0.2MM	–	CABGY2402E
8	1	RING CRIMP	–	CONRT24DG



NOTE:

1) TRIM BOOT TO 20MM AT SOCKET END.
2) USE APPROXIMATELY HALF OF THE SHIELD WIRES TWISTED TOGETHER AT SOCKET END TO FORM SCREEN CONNECTION.
3) SHRINK ITEM 6 OVER SHIELD CONNECTION AT SOCKET END.
4) SHRINK ITEM 5 MIDWAY OVER THE STRIPPED SHEATH AT SOCKET END ONLY.
5) WHEN SOLDERING CABLE TO SOCKET REFER TO TABLE FOR PIN CONNECTIONS.
6) FILL ITEM 1 WITH APPROVED NEUTRAL CURE SILICON ONLY AFTER FINAL TEST.
7) STRIP END OPPOSITE CONNECTOR TO SUIT APPLICATION. ENSURE SCREEN IS TRAPPED IN GLAND AS PER THE MANUAL.
8) ATTACH RING CRIMP (ITEM 8) AS LAST STEP AND FIX UNDER SCREW AS SHOWN.

WIRE COLOUR	SOCKET PIN NO.	DESCRIPTION	DESTINATION ON PCB
–	A	–	–
BLACK	B	GND	P17
–	C	–	–
–	D	–	–
GREEN	E	TX DATA	P16
WHITE	F	RX DATA	P15

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	26/02/01	REFER TO DR#776	A.C.
1.2	22/01/02	REFER TO DR#834	G.H.

TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
D.PLANTHABER	D.PLANTHABER	–
27/10/99	24/01/01	

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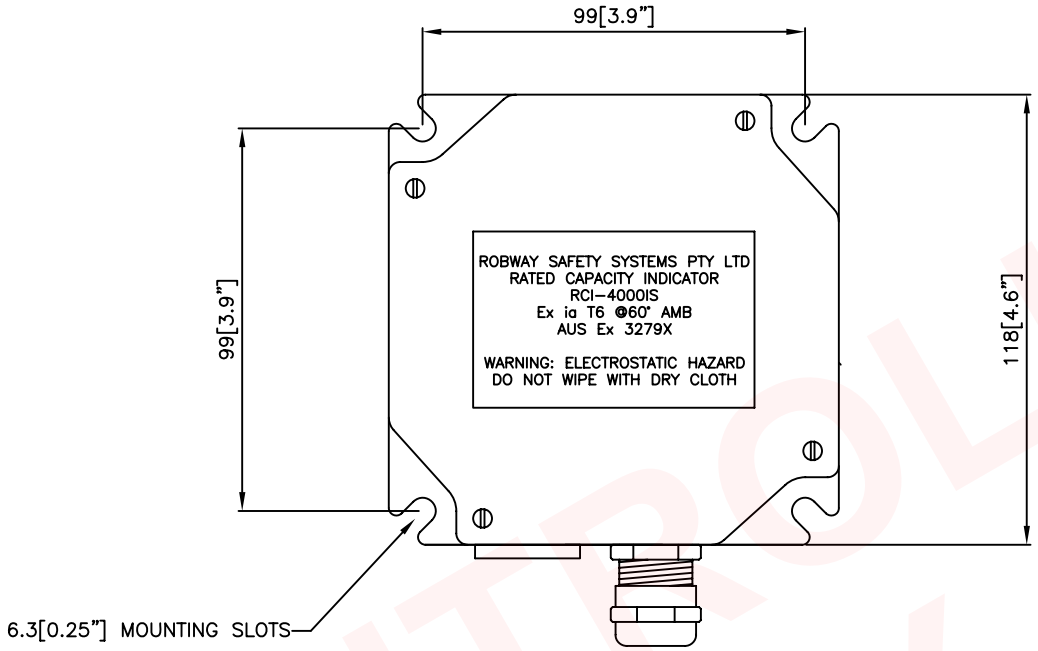
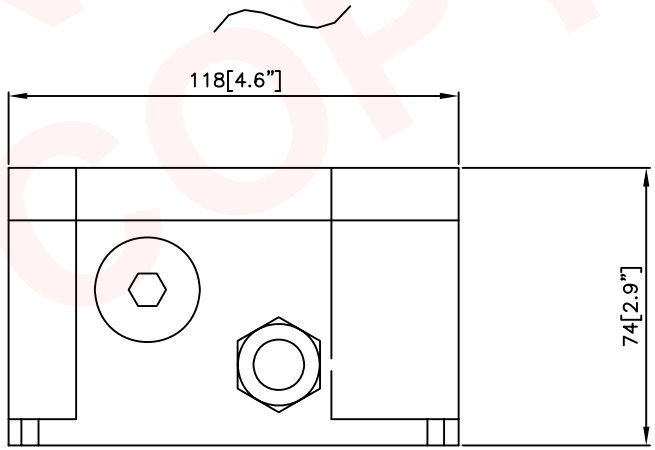
PART No: CABCOM2104
PROJECT: RCI–4000 CONTROL UNIT
TITLE: RS–232 COMMS CABLE
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 2104
FILE No: 210401AC.DWG
REV 1.2

3RD ANGLE





REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	10/07/02	REFER TO PR#67	G.H.
1.2	04/10/02	REFER TO PR#87	G.H.

TOL: X. +/- 1
X.X +/- 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
S. CHAMBERS	A. CANLAS	—
24/07/01	24/07/01	

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PART No: ANGCER03

PROJECT: CERTIFIED ANGLE SENSOR

TITLE: DIMENSIONAL DETAIL

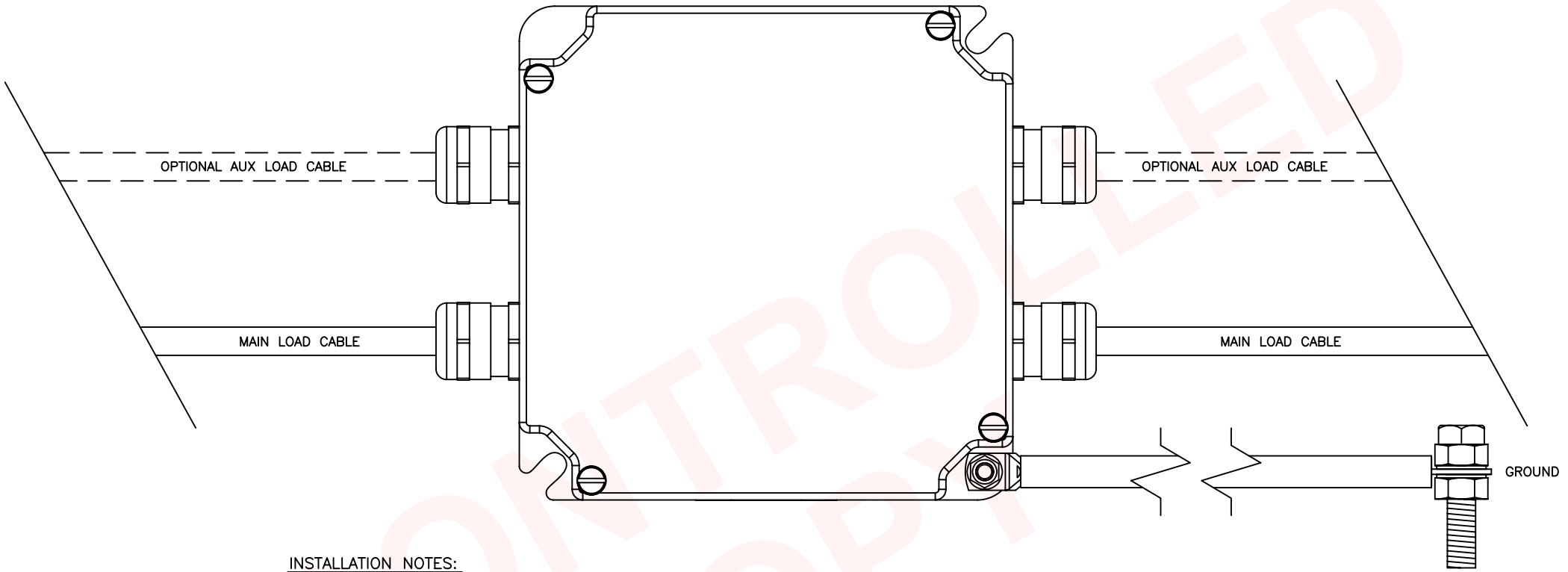
SCALE N/A

SHEET 1 OF 1

DRAWING No: DWG 2480

FILE No: 248001AC.DWG

REV 1.2



INSTALLATION NOTES:

1) LOCATE A SUITABLE LOCATION TO MOUNT THE LIGHTNING PROTECTOR (REFER TO DWG 3090 FOR MOUNTING DETAILS).
2) CUT THE CABLE LENGTH TO SUIT AND PREPARE THE LOAD CABLES (REFER TO SHEET 2).
3) INSERT THE LOAD CABLES INTO THE GLANDS AND WIRE IN THE CONDUCTORS (REFER TO SHEET 3).
4) SECURE ALL CABLES TO THE BOOM LACING USING THE CABLE TIES SUPPLIED IN THE KIT.
5) KEEP ALL EARTH LEADS AS SHORT AS POSSIBLE.
6) ATTACH THE EARTH CABLE TO THE HOSE CLAMP SUPPLIED IN THE KIT AND SECURE TO THE BOOM LACING (NOTE: MUST BE ATTACHED TO BARE METAL) <OR> ATTACH THE EARTH CABLE DIRECTLY TO THE BOOM USING THE M8 SCREW PROVIDED BY EITHER WELDING THE HEAD OF THE SCREW OR TAPPING AN M8X1.25 THREAD. IN ALL CASES THERE MUST BE A GOOD ELECTRICAL CONNECTION.
7) IF ARTICULATED ARMS ARE BEING USED ENSURE THE LOAD CABLE HAS ENOUGH FREEDOM TO MOVE AS THE ASSEMBLY FOLLOWS THE HOIST LINE.
8) FOLLOWING INSTALLATION CHECK THAT THE LOAD CABLE SHIELDS ARE ELECTRICALLY CONNECTED TO THEMSELVES AND TO THE BOOM CHASSIS.
9) THE USE OF A LIGHTNING ROD AT THE BOOM TIP WHICH IS CONNECTED TO AN EARTH BONDING CONDUCTOR IS STRONGLY RECOMMENDED, AS IS BONDING BETWEEN BOOM SECTIONS, ACROSS THE BOOM PIVOT, BETWEEN THE MACHINERY DECK AND THE TOWER, AND BETWEEN THE TOWER AND EARTH.
10) IT IS CRITICAL TO THE OPERATION OF THE PROTECTION TECHNIQUE THAT THE ABOVE INSTRUCTIONS ARE FOLLOWED PRECISELY.

REV	DATE	DESCRIPTION OF CHANGE	APPR'D

TOL: X. +/− 1
X.X +/− 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
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UNLESS OTHERWISE STATED

DRAWN	APPROVED
S. CHAMBERS	A. CANLAS
12/07/04	12/07/04

PART OF ASSY: —

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PART No: —

PROJECT: PROLOADT1

TITLE: TYPICAL INSTALLATION DETAILS

SCALE N/A

SHEET 1 OF 3

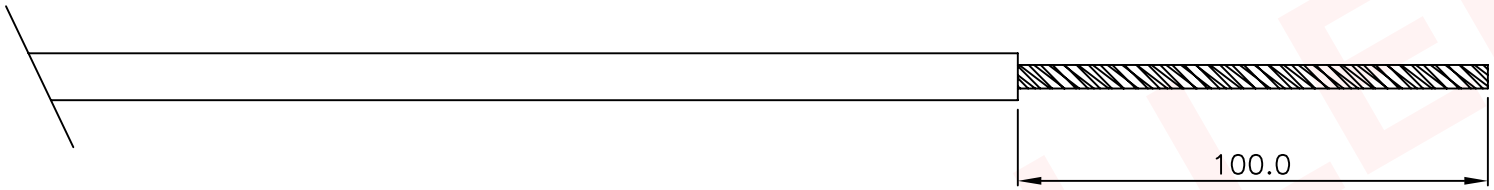
DRAWING No: DWG 3089

FILE No: 308901AA.DWG

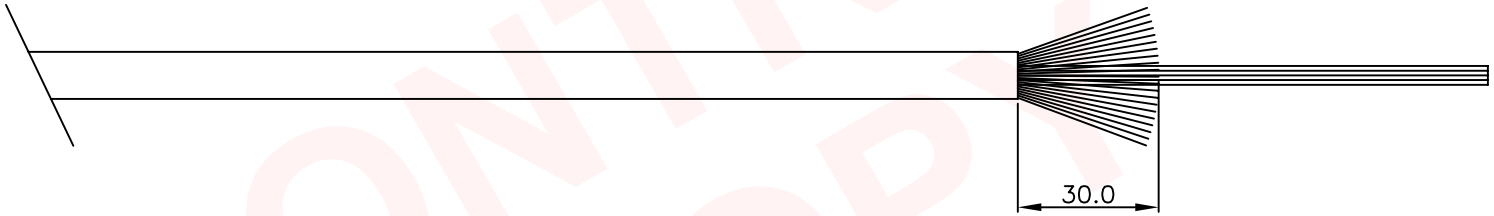
REV 1.0

LOAD CABLE PREPERATION

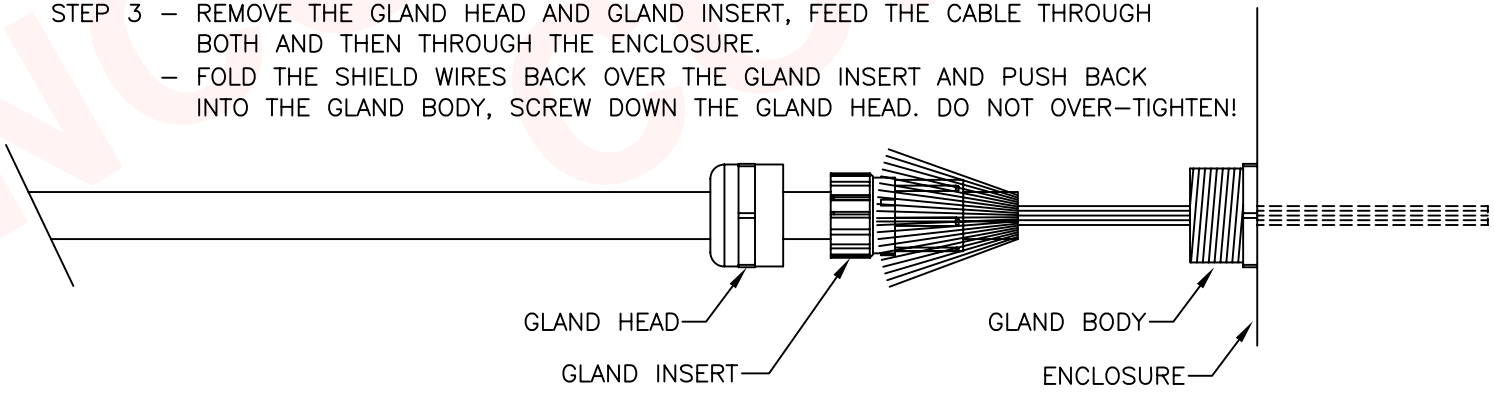
STEP 1 – STRIP OUTER SHEATH BACK 100MM.



STEP 2 – SEPERATE THE SHIELD INTO SINGLE STRANDS.
– CUT THE SHIELD BACK TO 30mm.



STEP 3 – REMOVE THE GLAND HEAD AND GLAND INSERT, FEED THE CABLE THROUGH BOTH AND THEN THROUGH THE ENCLOSURE.
– FOLD THE SHIELD WIRES BACK OVER THE GLAND INSERT AND PUSH BACK INTO THE GLAND BODY, SCREW DOWN THE GLAND HEAD. DO NOT OVER–TIGHTEN!



REV	DATE	DESCRIPTION OF CHANGE	APPR'D

TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
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DRAWN	APPROVED
S. CHAMBERS	A. CANLAS
12/07/04	12/07/04

PART OF ASSY: –

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FAX +61 8 352 1684

PART No: –

PROJECT: PROLOADT1

TITLE: TYPICAL INSTALLATION DETAILS

SCALE N/A

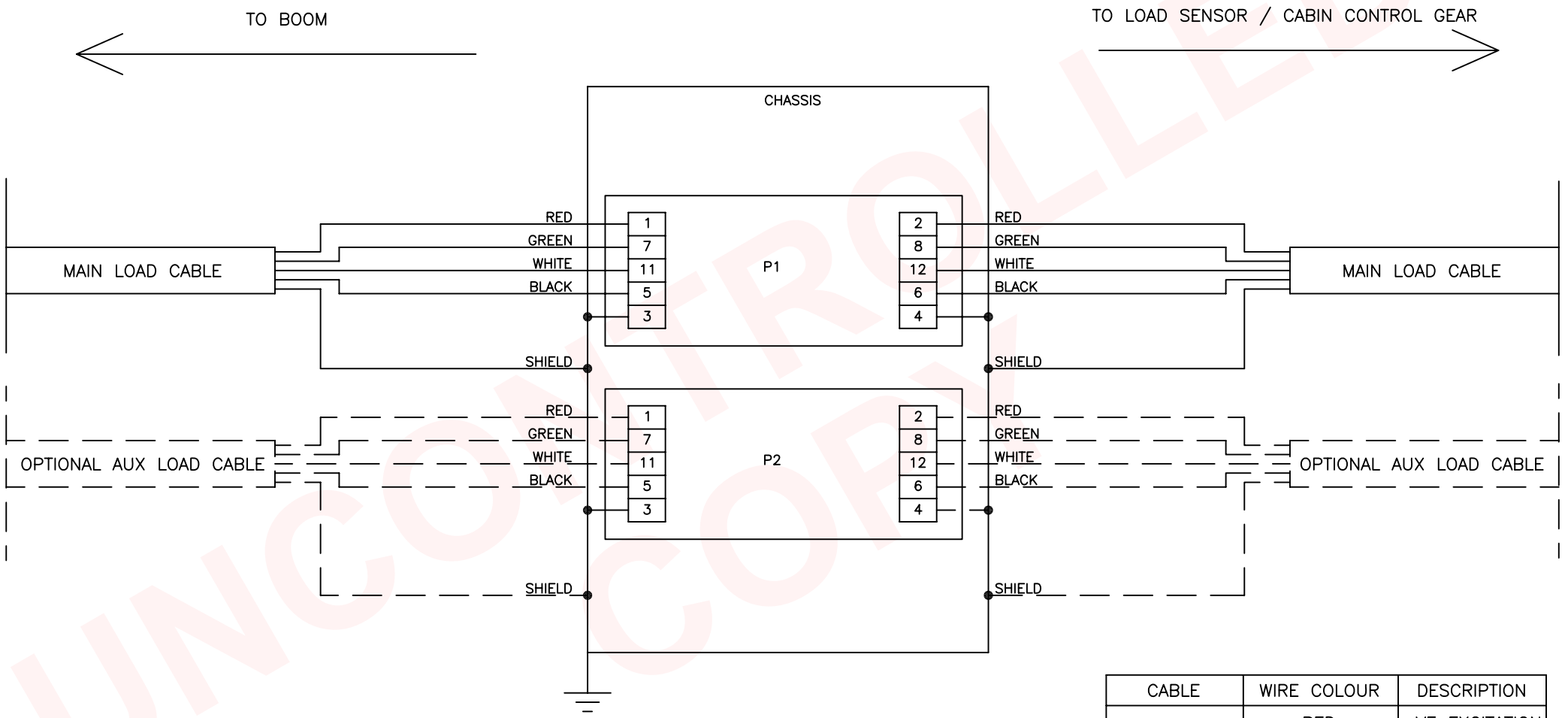
SHEET 2 OF 3

DRAWING No: DWG 3089

FILE No: 308901AA.DWG

REV 1.0

LOAD CABLE WIRING DIAGRAM



CABLE	WIRE COLOUR	DESCRIPTION
LOAD CABLE	RED	+VE EXCITATION
	BLACK	−VE EXCITATION
	GREEN	SIGNAL +VE
	WHITE	SIGNAL −VE

REV	DATE	DESCRIPTION OF CHANGE	APPR'D

TOL: X. +/− 1
X.X +/− 0.2
X.XX AS STATED

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UNLESS OTHERWISE STATED

DRAWN	APPROVED
S. CHAMBERS	A. CANLAS
12/07/04	12/07/04

PART OF ASSY: —

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PART No: —

PROJECT: PROLOADT1

TITLE: TYPICAL INSTALLATION DETAILS

SCALE N/A

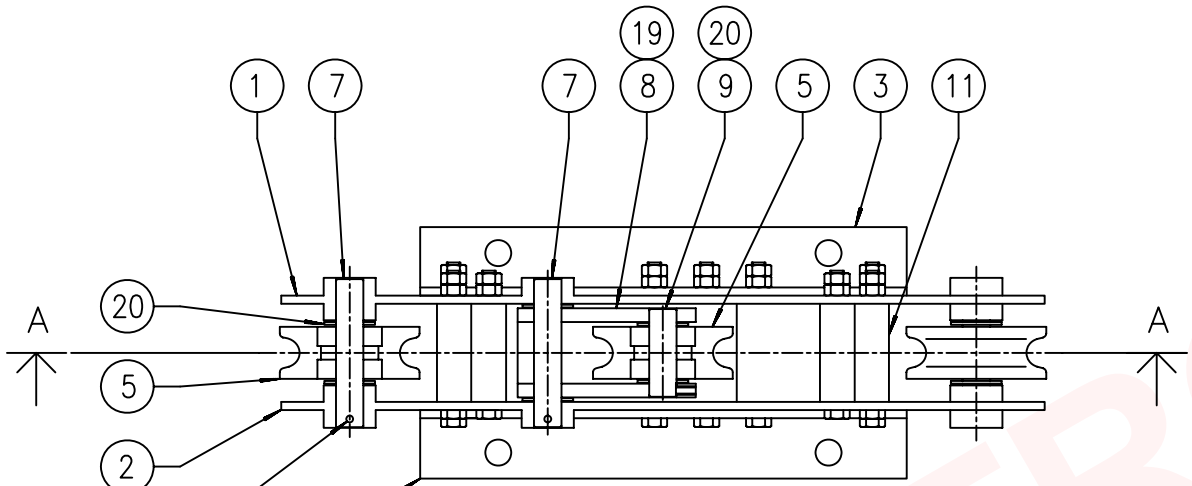
SHEET 3 OF 3

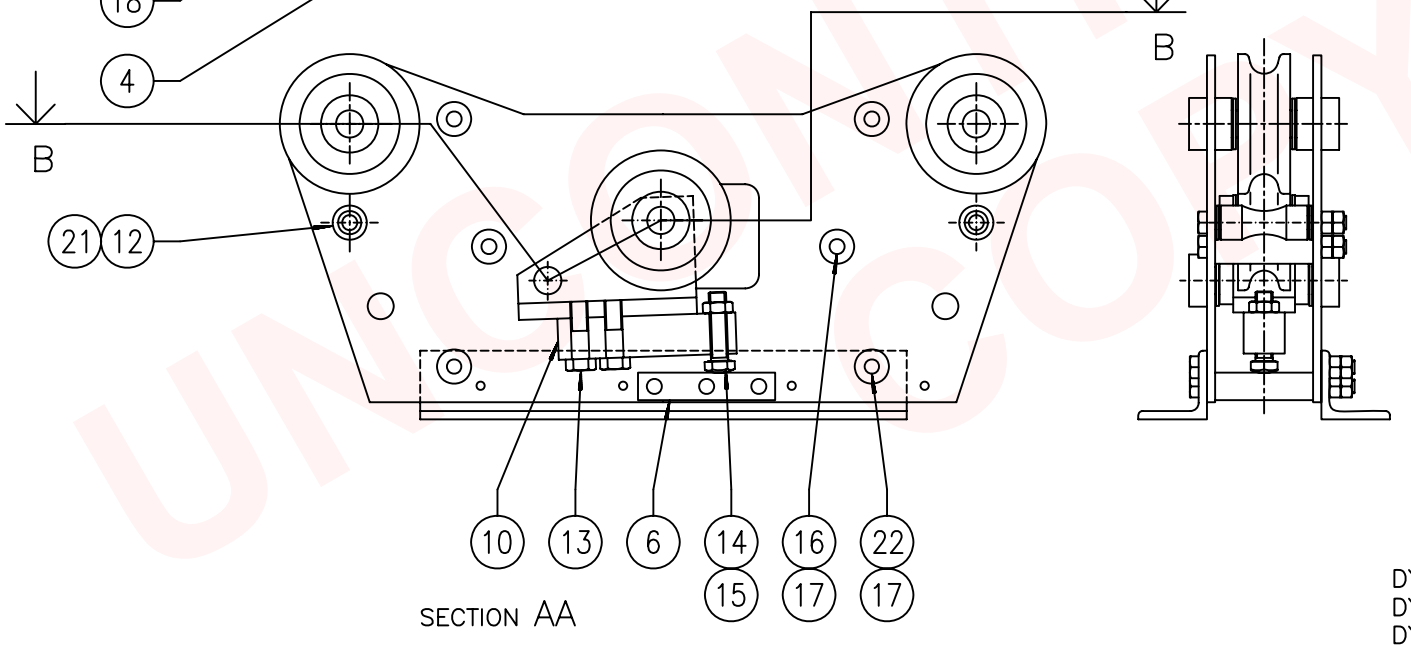
DRAWING No: DWG 3089

FILE No: 308901AA.DWG

REV 1.0

3RD ANGLE





ITEM	QTY	MATERIAL/DESCRIPTION	DWG No.	STOCK CODE (STANDARD)	STOCK CODE (MARINE S/S)
1	1	SIDE PLATE–RIGHT	DWG0203	PLAHRT10	PLAHRT10SS
2	1	SIDE PLATE–LEFT	DWG0203	PLAHRT13	PLAHRT13SS
3	1	MOUNT ANGLE BRACKET RIGHT HAND	DWG0299	BRAHRT04	BRAHRT04SS
4	–	MOUNT ANGLE BRACKET LEFT HAND	DWG0299	BRAHRT03	BRAHRT03SS
5	3	SHEAVE ASSY ø14 CABLE	DWG0345	SHEH32014	–
	3	OR ø16 CABLE	DWG0345	SHEH32016	–
	3	OR ø20 CABLE	DWG0345	SHEH32020	–
	3	OR ø26 CABLE	DWG0345	SHEH32026	–
	3	OR ø29 CABLE	DWG0345	SHEH32029	–
6	1	LOAD PLATE	DWG0302	PLAHRT08	PLAHRT08SS
7	3	SHAFT–SHEAVE	DWG0225	SHAHRT12	–
8	1	ROCKER BOX	DWG0346	ROC3MAR	ROC3MARSS
9	1	SHAFT–SHEAVE–ROCKER BOX	DWG0289	SHAHRT11	–
10	1	LOAD CELL ASSY–5K–WITH PLUG	–	CELBTD5P	–
	1	LOAD CELL ASSY–5K–NO PLUG	–	CELBTD5	–
11	6	SPACERS	DWG0301	SPAHRT06	SPAHRT06SS
12	2	KEEPER–CABLE	DWG0300	KEEHRT02	KEEHRT02SS
13	2	BOLT–CELL MOUNTING 1/2"X1 3/4" SS	–	BOL1213HHSS	–
14	1	LOADING BOLT 1/2"X2" SS	DWG0287	SCR122CZP	–
15	1	LOCK NUT 1/2" UNF SS	–	NUT12HLSS	–
16	6	M10X100 HEX HEAD BOLT	–	BOLM10100HG	BOLM10100HSS
17	22	M10 HALF SIZE LOCK NUT	–	NUTM10HLG	NUTM10HSS
18	3	SPLIT PIN ø4X50 SS	–	PINCOTT03	–
19	1	SOC GRUB SCREW M6X12 CUP PT	–	SCRM612SG	–
20	8	M20 FLAT WASHER	–	WASM20FZP	WASM20FSS
21	26	M10 FLAT WASHER	–	WASM10FZP	WASM10FSS
22	5	M10X120 HEX HEAD BOLT	–	BOLM10120HG	BOLM10120HSS

DYNHRT3 – STANDARD (NO SHEAVES)
DYNHRT3 – STANDARD (INCLUDING SHEAVES)
DYNHRT3SS – STAINLESS STEEL MARINE (NO SHEAVES)

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.0	14/09/95	ISSUED FOR MANUFACTURE	
1.1	04/01/96	ITEMS 3&4 CHANGED AS PER DR#124	M.O.
1.2	27/08/97	REFER TO DR#318	M.O.
1.3	29/03/99	REFER TO DR#551	M.G.
1.4	27/01/05	REFER TO DR#345	G.C.

TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
F. LOCKER	M. OBST	–
14/09/95	14/09/95	

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SOUTH AUSTRALIA
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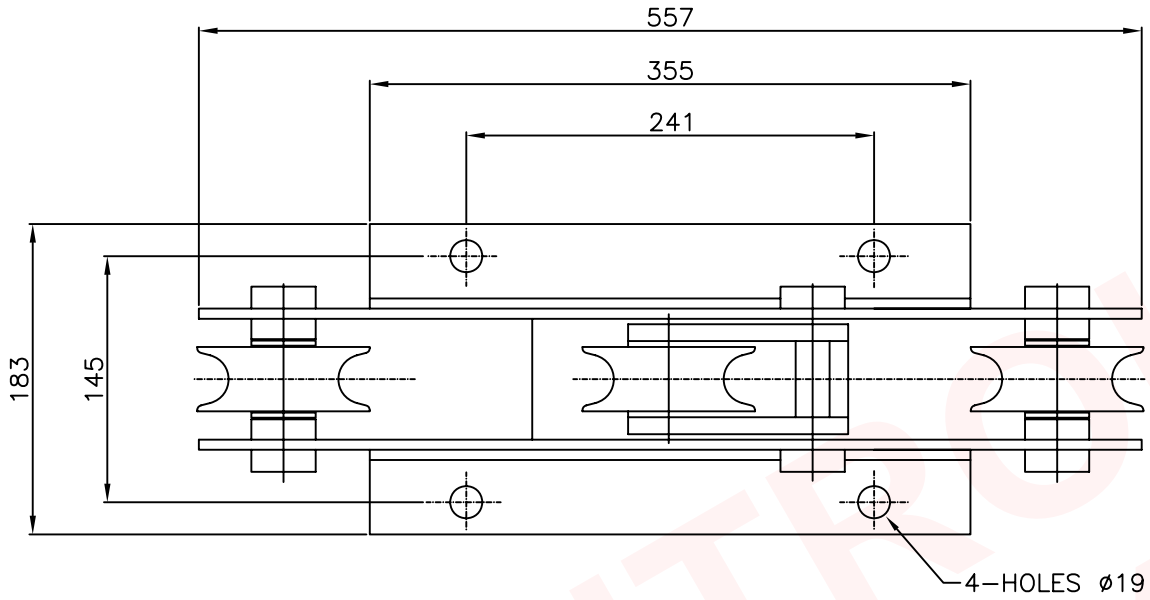
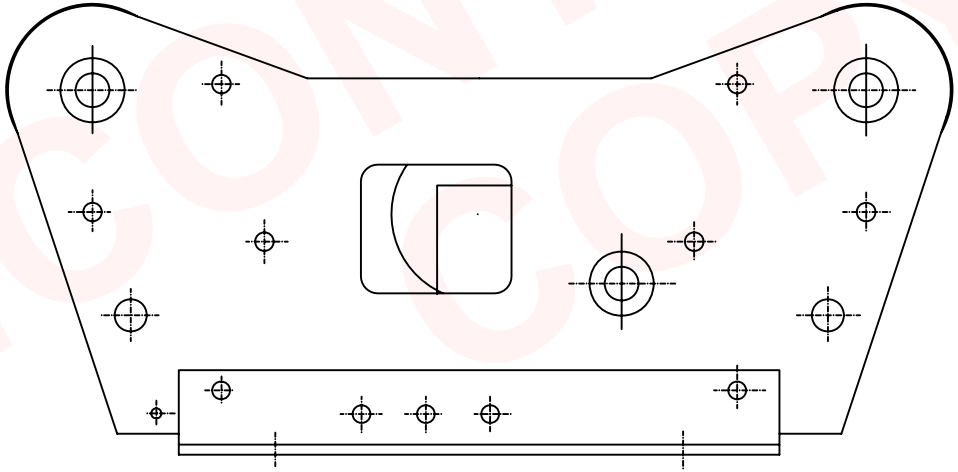
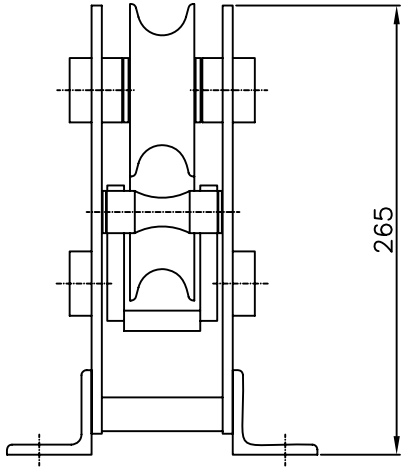
FAX +61 8 8352 1684

PART No: AS ABOVE
PROJECT: HRT–3 DYNO
TITLE: GENERAL ARRANGEMENT
SCALE N/A
SHEET 1 OF 2
DRAWING No: DWG 0422
FILE No: 042201AE.DWG
REV 1.4

3RD ANGLE







REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.0	14/09/95	ISSUED FOR MANUFACTURE	
1.1	04/01/96	ITEMS 3&4 CHANGED AS PER DR#124	M.O.
1.2	27/08/97	REFER TO DR#318	M.O.
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1.4	27/01/05	REFER TO DR#345	G.C.

TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
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UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
F. LOCKER	M. OBST	–
14/09/95	14/09/95	

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SOUTH AUSTRALIA
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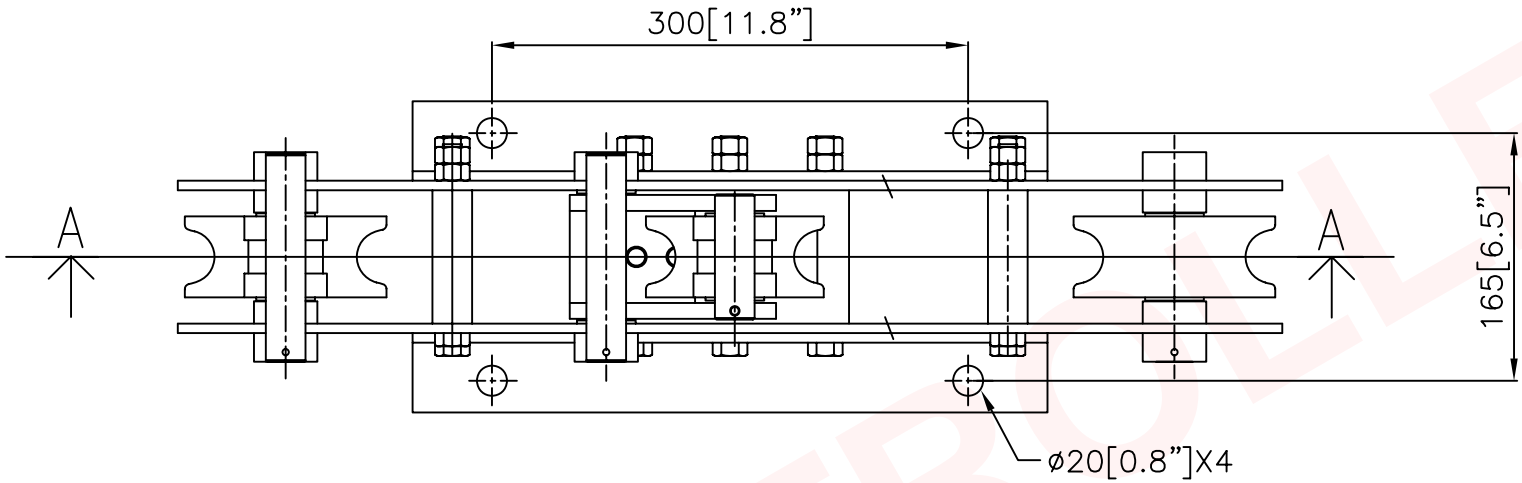
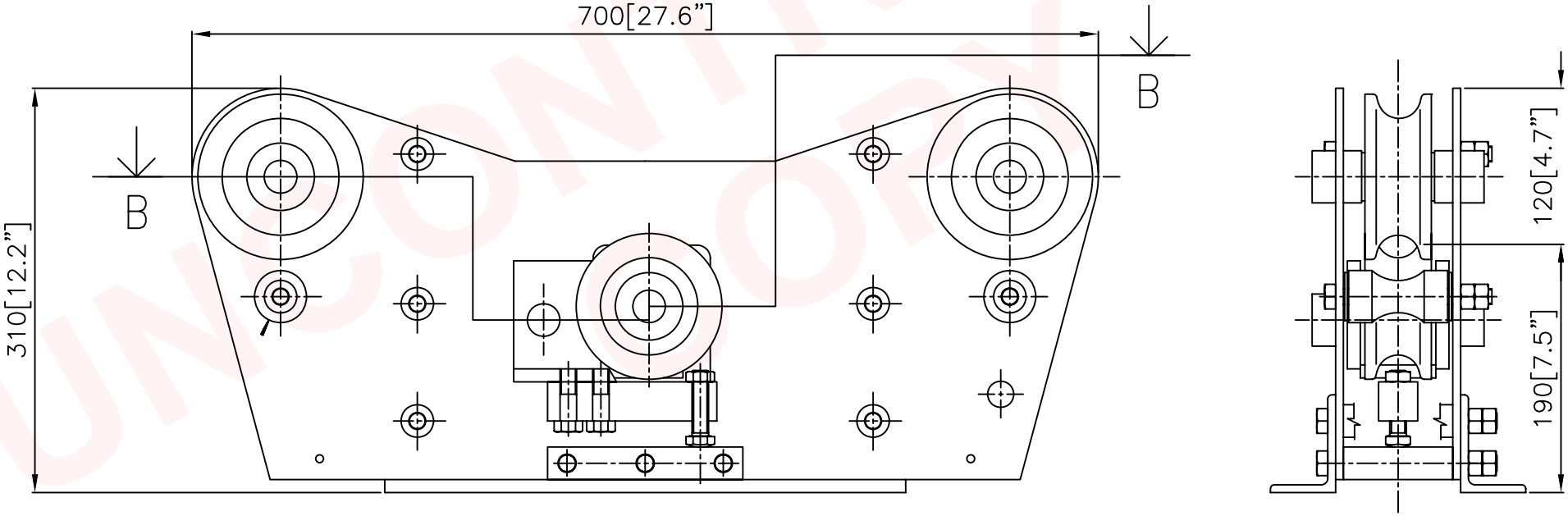
FAX +61 8 8352 1684

PART No: AS ABOVE
PROJECT: HRT–3 DYNO
TITLE: GENERAL ARRANGEMENT
SCALE N/A
SHEET 2 OF 2
DRAWING No: DWG 0422
FILE No: 042201AE.DWG
REV 1.4

3RD ANGLE

SECTION B B





SECTION A A

REV	DATE	DESCRIPTION OF CHANGE	APPR'D

TOL: X. +/- 1
X.X +/- 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE
IN MILLIMETERS[INCHES]
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
C. HOBBY		–
05/11/98		

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PART No: –

PROJECT: HRT–4 DYNO

TITLE: HRT–4 DYNAMOMETER DIMENSIONAL DETAIL

SCALE N/A

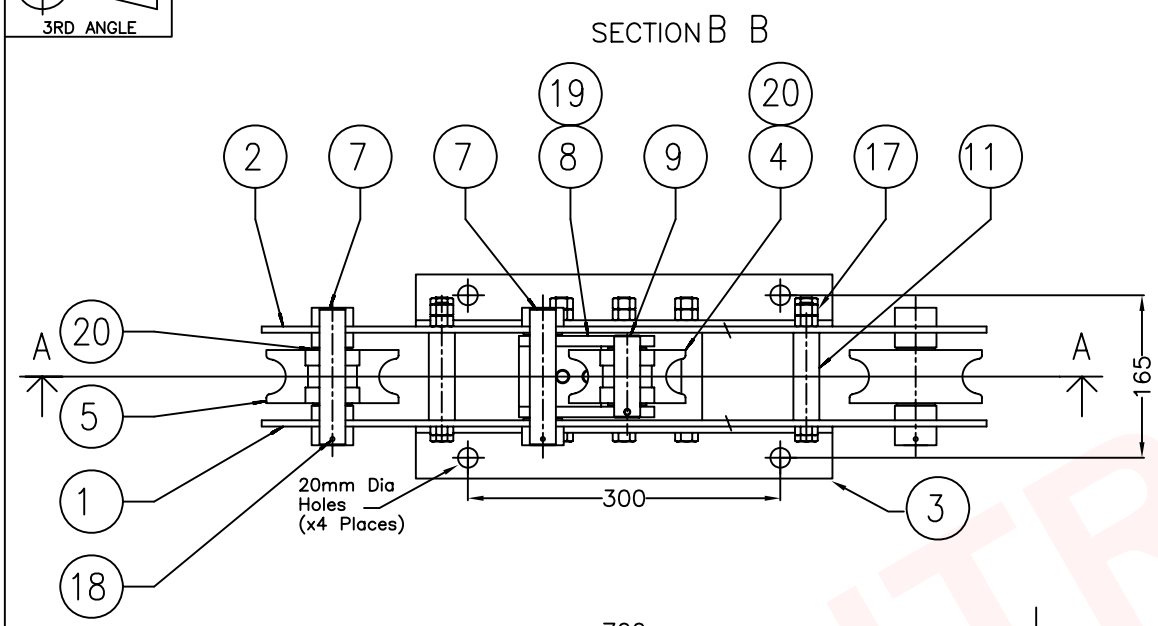
SHEET 1 OF 1

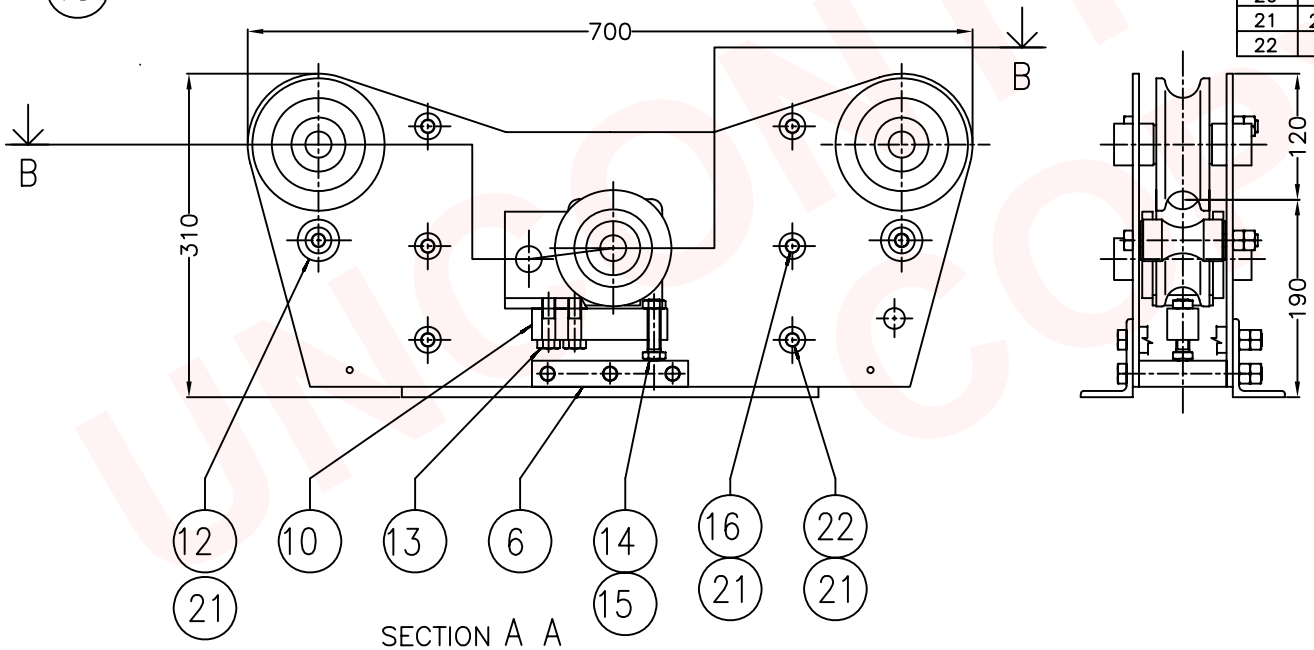
DRAWING No: DWG 1795

FILE No: 179501AA.DWG

REV 1.0

3RD ANGLE





ITEM	QTY	MATERIAL/DESCRIPTION	DWG No.	STOCK CODE (STANDARD)	STOCK CODE (MARINE S/S)
1	1	SIDE PLATE RIGHT	DWG0272	PLAHRT4RH	PLAHRT4RHSS
2	1	SIDE PLATE LEFT	DWG0272	PLAHRT4LH	PLAHRT4LHSS
3	2	MOUNT ANGLE BRACKET	DWG0273	BRAHRT4V	BRAHRT4VSS
4	1	SHEAVE ASSY ø26 CABLE	DWG0348	SHE4C2526	–
	1	OR ø29 CABLE	DWG0348	SHE4C2529	–
	1	OR ø33 CABLE	DWG0348	SHE4C2533	–
5	2	SHEAVE ASSY ø26 CABLE	DWG0348	SHE4E2526	–
	2	OR ø29 CABLE	DWG0348	SHE4E2529	–
	2	OR ø33 CABLE	DWG0348	SHE4E2533	–
6	1	LOAD PLATE	DWG0350	PLAHRT4LD	PLAHRT4LDSS
7	3	SHAFT–SHEAVE	DWG0280	SHASH4	–
8	1	ROCKER BOX	DWG0349	ROCHRT4	ROCHRT4SS
9	1	SHAFT–SHEAVE–ROCKER BOX	DWG0347	SHARBSH4	–
10	1	LOAD CELL ASSEMBLY–5K–WITH PLUG	–	CELBTD5P	–
	1	OR WITHOUT PLUG	–	CELBTD5	–
11	6	SPACERS	DWG0352	SPAHRT4	SPAHRT4SS
12	2	KEEPER CABLE	DWG0351	KEEHRT4	KEEHRT4SS
13	2	BOLT–CELL MOUNTING 1/2"X1 3/4"	–	BOL1213HHSS	–
14	1	SCREW–ADJUSTMENT 1/2"X2"	–	SCR122CSS	–
15	1	LOCK NUT 1/2" UNF	–	NUT12HLSS	–
16	6	M12X120 HEX HEAD GALV	–	BOLM12120HG	BOLM12120SS
17	22	NUT M12 HALF SIZE LOCK NUT GALV	–	NUTM12HLG	NUTM12HSS
18	3	SPLIT PIN ø4X50 S/S	–	PINCOTT03	–
19	1	SOC GRUB SCREW M6X12 CUP PT S/S	–	SCRM612SG	–
20	8	WASHER M24 ZP	–	WASM24FZP	WASM24FSS
21	26	WASHER M12 ZP	–	WASM12FZP	WASM12FSS
22	5	BOLT M12X130 HEX HEAD GALV	–	BOLM12130HG	BOLM12130HSS

DYNHRT4 – STANDARD (NO SHEAVES)
DYNHRT4S – STANDARD (INCLUDING SHEAVES)
DYNHRT4SS – STAINLESS STEEL MARINE (NO SHEAVES)

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	11/01/96	CORRECT PART 14 AS PER DR#125	
1.2	04/09/96	REFER TO DR#197	J.D.R.
1.3	30/10/97	REFER TO DR#318	M.O.
1.4	26/03/99	REFER TO DR#551	D.P.
1.5	27/01/05	REFER TO DR#345	G.C.

TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

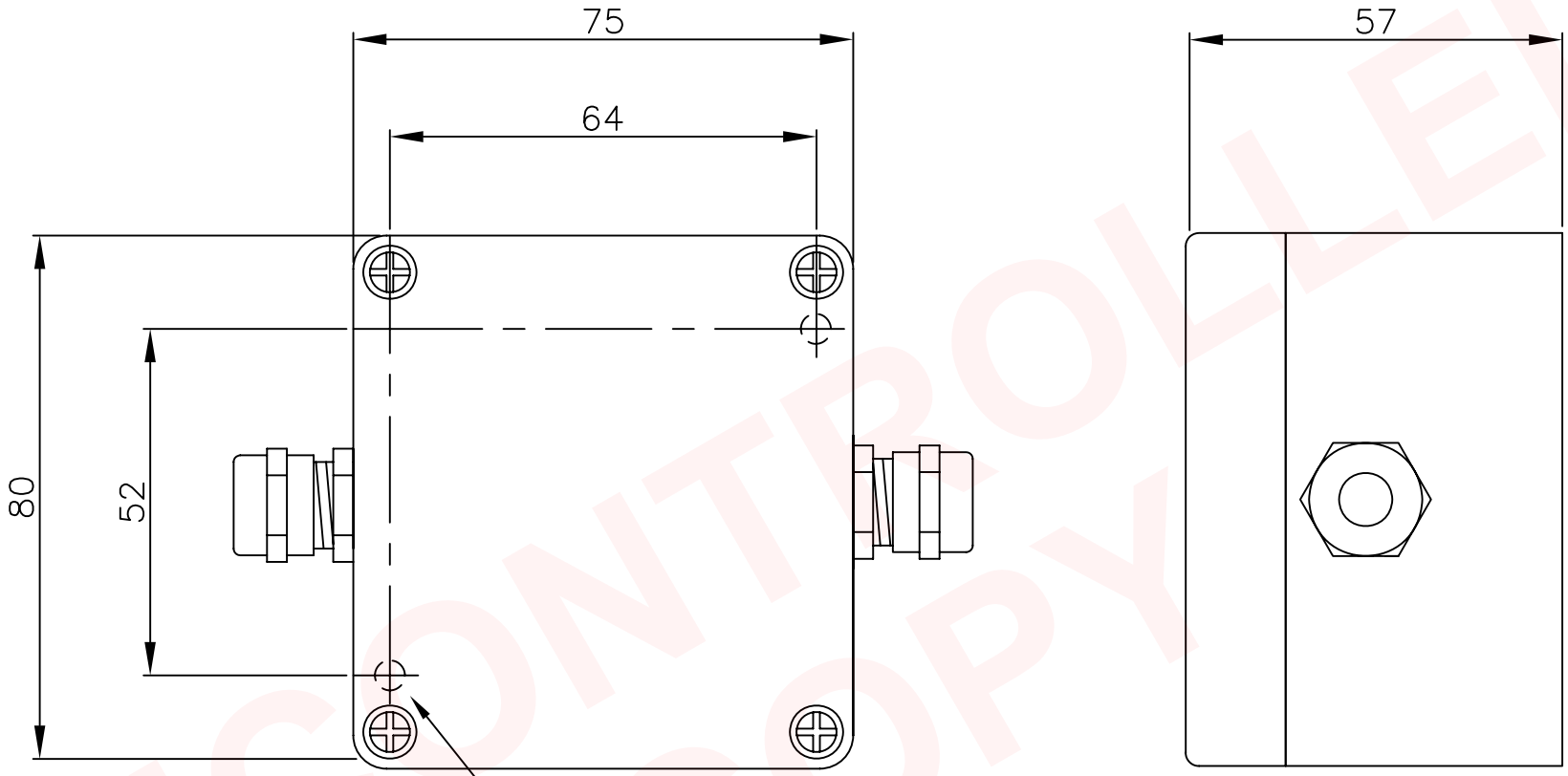
DRAWN	APPROVED
F. LOCKER	M. OBST
07/09/95	07/09/95

PART OF ASSY: –

ROBWAY SAFETY SYSTEMS PTY LTD
32 WEST THEBARTON RD
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 8352 6055
FAX +61 8 8352 1684

PART No: AS ABOVE
PROJECT: HRT–4 DYNO
TITLE: GENERAL ARRANGEMENT
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 0796
FILE No: 079601AF.DWG
REV 1.5

3RD ANGLE



REV	DATE	DESCRIPTION OF CHANGE	APPR'D

TOL: X. +/- 1
X.X +/- 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
S. CHAMBERS	A. CANLAS	–
23/07/01	23/07/01	

ROBWAY SAFETY SYSTEMS PTY LTD
32 WEST THEBARTON RD
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 352 6055
FAX +61 8 352 1684

PART No: –

PROJECT: JUNCTION BOX

TITLE: JUNCTION BOX
DIMENSIONAL DETAIL

SCALE N/A

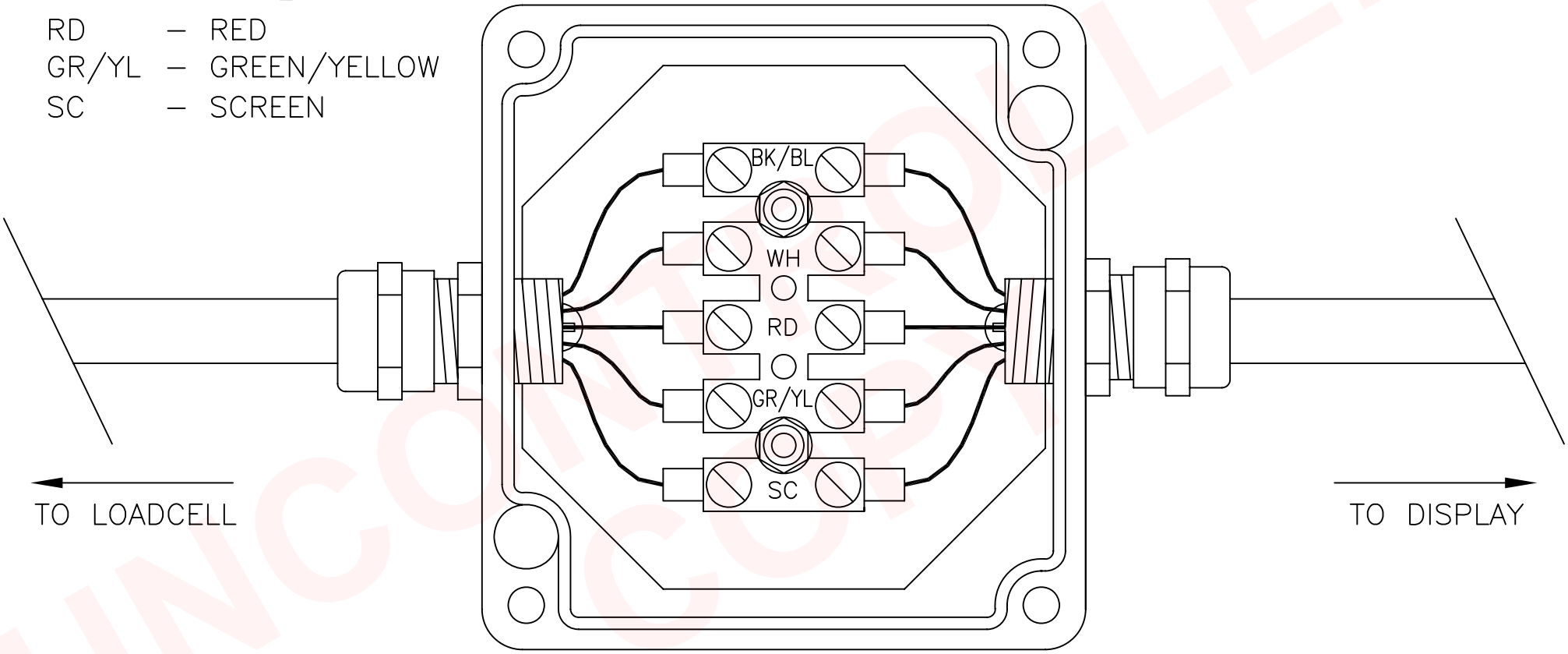
SHEET 1 OF 1

DRAWING No: DWG 2475

FILE No: 247501AA.DWG

REV 1.0

BK/BL – BK/BL
WH – WHITE
RD – RED
GR/YL – GREEN/YELLOW
SC – SCREEN



REV	DATE	DESCRIPTION OF CHANGE	APPR'D

TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
S. CHAMBERS	A. CANLAS	–
23/07/01	23/07/01	

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THEBARTON 5031
SOUTH AUSTRALIA
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FAX +61 8 352 1684

PART No: –
PROJECT: DYNO JUNCTION BOX
TITLE: DYNO JUNCTION BOX WIRING DETAILS
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 2474
FILE No: 247401AA.DWG
REV 1.0