RCI-1502 HRT Strut Boom System
Instruction Manual

MAN-1071 Rev D

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1. Important Safety Notice

The RCI-1502 System is a crane device which warns the operator of impending overload conditions and of 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.

SPECIAL NOTE FOR TENSIOMETER INSTALLATION AND USE

Please Note: Remove tensiometers during dragline and piling operations.

Tensiometers (dynamometers/line-riders) are NOT designed for use on wire ropes performing Piling operations due to the high cycle and high speeds combined with high linepulls.

Please ensure they are removed before commencing operations.

Robway and distributors will not accept responsibility for either rope or tensiometer damage resulting from this type of use.

2. General Description

This Manual contains general information, installation, operation, calibration, maintenance and parts information for the RCI-1502 Rated Capacity Indicator to suit various Strut (Lattice) boom mobile cranes.

Refer to drawing DWG 2466 “RCI-1502 GENERAL ARRANGEMENT FOR TYPICAL STRUT BOOM HRT SYSTEM” on Section 8.2. of the Manual for an overview of the System.

Drawing (DWG) Numbers, where applicable in the following Sections, are also provided for quick reference.

The RCI-1502 is a fully automatic Rated Capacity Indicator which provides a display of the following functions:

- Boom Length,
- Boom Angle,
- Hook Radius,
- S.W.L. (Safe Working Load),
- Hoist Rope Falls,
- Duty (Configuration),
- Actual Load of Selected Winch (Main or Aux),
- Percentage of SWL (3 coloured lamps - green, amber, and red).

The RCI-1502 display also provides the following features:

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

3. Operating Instructions

The following sections explain how to operate the RCI-1502 and make best use of its capabilities.

3.1. Turning On the RCI-1502

Power to the unit is from the crane battery (nominal 12 or 24 volts dc) through the start-up or ignition key. In some applications an additional switch may be used to enable the operator to switch the unit on/off as required.

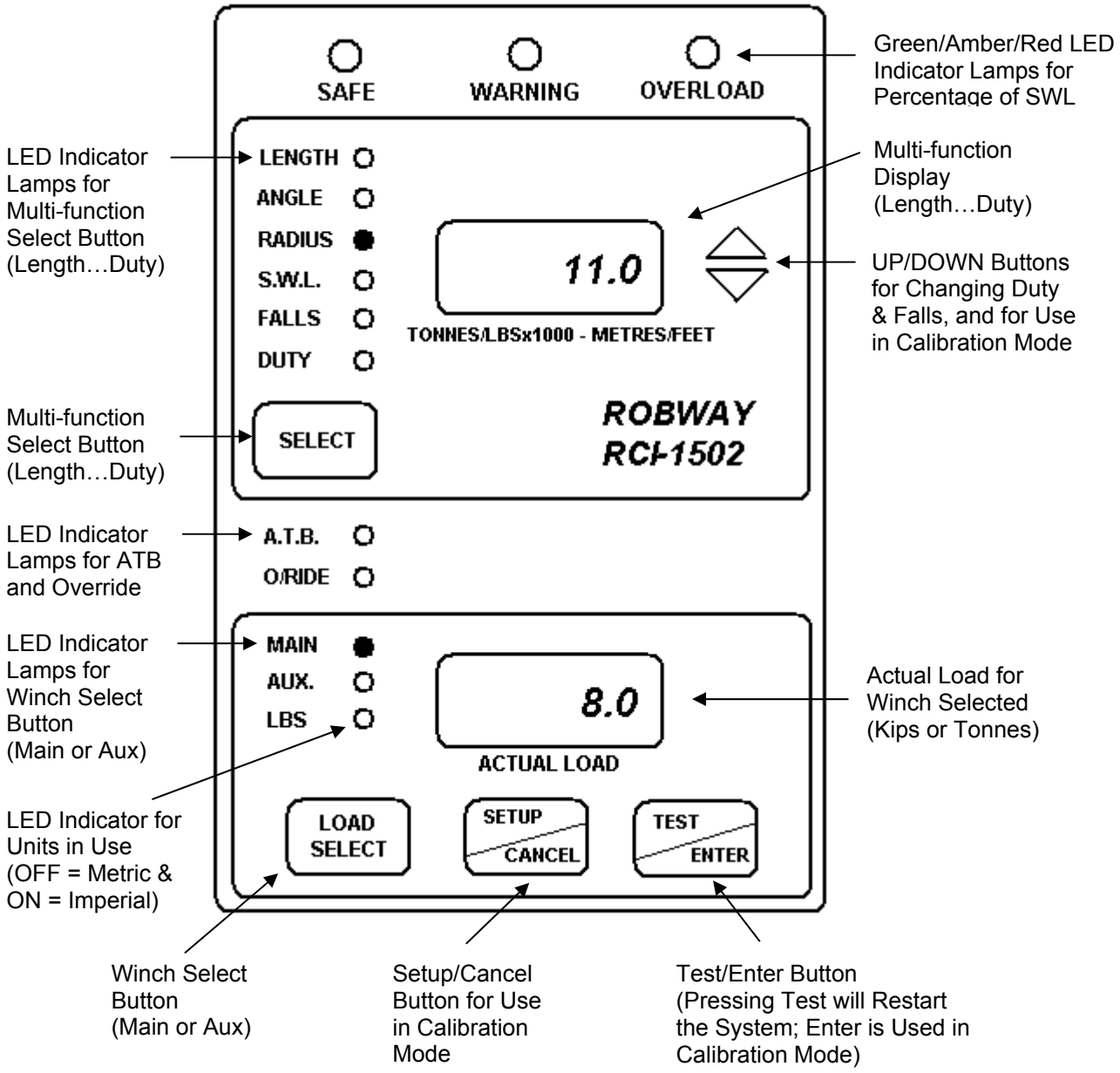
As soon as power is applied to the unit, its display and other indicators should light up and the unit should go through its self-test operation.

3.2. Turning OFF the Unit

The unit will stop working as soon as the power is removed from it by switching off any of the switches indicated in Section 3.1 above.

3.3. Operating Screen

The following is the operating screen of the RCI-1502 showing the general display functions:



3.4. Display Functions

The RCI-1502 has 2 LCD display windows and 6 front panel push buttons. The display panel can also be grouped into four parts as follows:

3.4.1. "Approach to Rated Capacity" Indication Lamps

This is the uppermost part of the display which contains three coloured lamps to indicate "approach to rated capacity". Factory settings are as follows:

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

3.4.2. Numerical LCD for Various Functions

This is a numerical LCD display, just below the indication lamps mentioned above, which shows the LENGTH, ANGLE, RADIUS, S.W.L., FALLS, and DUTY 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 6. "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:

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.

RADIUS

The numerical display shows the current working radius, in unit selected (feet or metres), for the winch selected.

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 (duty), winch selected (if twin winch), the maximum linepull and the falls selected.

FALLS

The numerical display shows the number of falls *(parts of line)* used for 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, make sure the correct winch is selected.

DUTY

The numerical display shows the current duty (or configuration) number selected. Each system manual is supplied with a DUTY LISTING for a given application. Please refer to the DUTY LISTING at the rear of the manual for a description of the duties. A plastic encapsulated version is also supplied with the system for the crane operator's quick reference in the cabin.

To change the Duty number, use the UP/DOWN key to ramp to the desired value, while the DUTY LED indicator is on.

3.4.3. A.T.B. (Anti-Two-Block) and O/RIDE (Override) Indication LEDs

This part of the display has two red LED's which shows the current status of the following functions:

O/RIDE - LED ON when over-ride/bypass key is switched on.
A.T.B. - LED ON when on two-blocking condition.

The RCI-1502 is supplied with a standard Anti-Two-Block (ATB) input for connecting an optional 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.

3.4.4. Numerical LCD for Current Load Readout

This part has a numerical LCD which 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 (kips, 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-1502 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.

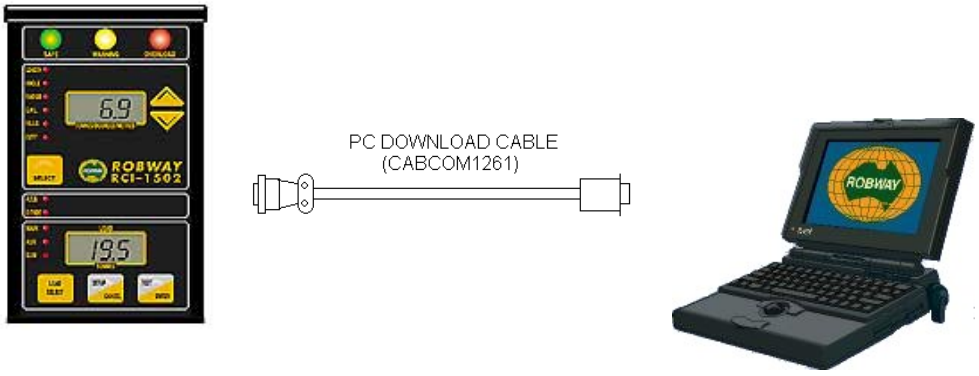
When the ACTUAL LOAD exceeds the SWL for the current crane configuration the RCI-1502 will activate audible and visual alarms.

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.

3.5 Data Logging and Data Downloading

For downloading data to PC, connect the Data-Logging Download Cable (Part No. CABCOM 1261) between the RS-232 socket at the back of the RCI-1502 display and the PC.



Please refer to Section 8.1. "DATA LOGGING ON RCI SYSTEMS" at the rear of the manual for usage information and details.

4. 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 orientated for right hand side (RHS) of the boom in a convenient position close to the operator's cab by bolting/welding the mounting bracket provided in a vertical plane at 90 degrees to the boom centreline.

It is usual to fit the angle sensor to the 'inside' of the LHS boom butt section. This position usually provides good mechanical protection. Ensure the arrow on the enclosure is pointing to the boom tip.

Mount/bolt the sensor on the mounting bracket and route the cable carefully around the boom pivot to the cab. Clip the cable to the boom and turret using adequate straps/cable ties provided ensuring that cable is not pinched or stretched as boom moves through its full luffing arc (see also “Cabling – Boom Sensors” item in this Section). Only connect the plug when finished welding.

Drawing Reference:
DWG 1099 – “Electronic Angle Sensor, Dimensional Drawing”

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

Electronic angle sensor and typical installation at the boom butt section

Load Sensor

The RCI-1502 System uses tension-based load sensing method which directly senses the line-pull generated when lifting the load. Sensors can be dynamometers/tensiometers (also known as line-riders) or tension plate type cells fitted into the dead-end of the hoist reeving. Load-pin type load-cells may also be used.

Dynamometer/Tensiometer Type

Please Note:
Remove tensiometers during dragline and piling operations. Refer to Section 1. “Important Safety Notice” – Special Note for Tensiometer Installation & Use.

This is a three-pulley arrangement load sensor with a beam type loadcell (model RW5000) mounted within. The tensiometer monitors the hoist rope line-pull as the hoist rope passes through the three sheaves. The tensiometer 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 or fitted with articulating arm assembly at the boom butt section. The arcticulating arm assembly allows the unit to follow the natural position of the hoist rope relative to the boom itself.

Mounting the dynamometer using an articulating arm on lattice boom cranes requires two cross braces to be fitted to the boom top chords. One to be utilised as a 'take-off' point for the articulating arm and the other to secure timber to create a 'landing zone' for the tensiometer so as to not damage the boom chords or lacing during fast hoist rope working.

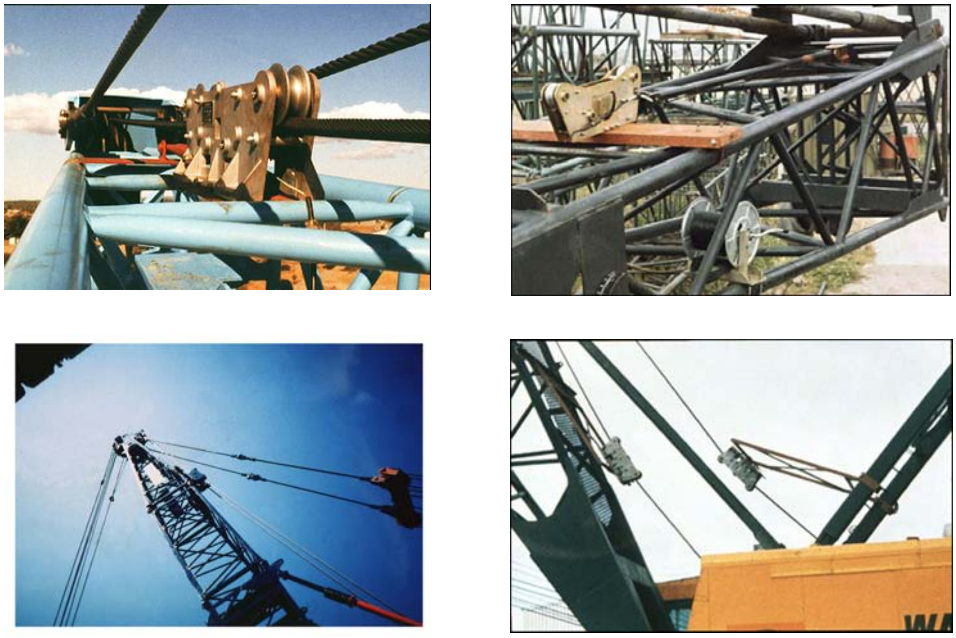
For cranes without fly-jibs, the dynamometers/tensiometers are usually rigidly mounted on the boom tip section. Fabricated brackets may be required to attach the tensiometer to the boom top and align it to the hoist rope.

For cranes with fly jibs, the fly-jib mast aux winch idler sheave necessitates using an articulating arm mounting to allow the tensiometer to follow the aux rope natural line over the mast idler sheave. Alternatively, the tensiometer may be mounted on the fly-jib tip section, or, off the boom butt section using an articulating arm if the aux and main winches are side by side.

The beam type loadcell inside the dynamometer outputs an electrical signal proportional to the hoist rope line-pull forces which the RCI-1502 unit then converts into hook-load weight. Correctly following the calibration procedures is essential for accurately determining the hook load weight.

Drawing References:

DWG 1393 – “Overall Dimensions, HRT-3MM Micro-Mini Dynamometer”
DWG 0875 – “General Arrangement, HRT-3MM Dynamometer”
DWG 0422 (Sheets 1-2 of 2) – “General Arrangement, HRT-3 Dyno”
DWG 0104, 0786, 0787 – “Parts List for HRT-3 Dynamometer”
DWG 1795 – “Dimensional Detail, HRT-4 Dynamometer”
DWG 0796 – “General Arrangement, HRT-4 Dynamometer”
DWG 0799, 0340 – “Parts List for HRT-4 Dynamometer”
DWG 0370 – “General Arrangement, Standard Artic. Arm for Dyno”
DWG 0805 – “General Arrangement, Heavy Duty Artic. Arm for Dyno”
DWG 2468 (Sheets 1-4 of 4) – “Typical Installation of Dyno on Strut Boom Cranes”



Typical installation of dynamometers/tensiometers on strut boom cranes

Tension Cell Type

A tension plate-type load cell may be fitted at the hoist rope dead-end of the boom tip section to sense the hoist line-pull. Robway tension cells are supplied with standard “side plates” (or “sister plates”) to provide extra protection against extreme twisting during crane operation.

Special fittings such as an “adapter plate assembly” may be required to fix the tension cell between the boom lug (pad eye) and hoist rope wedge socket. This adapter plate assembly must be specially-fabricated and supplied by the customer to suit the dimensions of the lug and socket at the dead-end termination point. It should be fabricated from high-tensile grade material such as “Bisalloy 80 Steel” for plates and “grade 4140” for pins, and should also provide for the existing wedge socket and pin to be re-used. Robway also recommends that the adapter plate assembly be proof-load tested by a certification body prior to installing it on the crane.

Alternatively, Robway can supply the adapter plate assembly (proof-load tested and certified) at extra cost at the time of ordering the RCI-1502 system. Dimensional details of the lug, wedge socket and pin will also be required by Robway at the time of ordering.

Drawing References:

DWG 0990 – “Tension Plate Cell Dimensions”

Tension cell with Robway-manufactured adapter plate assembly and typical installation on hoist rope deadend

Load Pin Type

The load pin is fitted to and is utilised for the axle shaft of a Single-Sheave Dynamometer. This type of dynamometer can either be supplied by Robway, or fabricated/supplied by the customer. For customer-supplied dynamometer, Robway will only supply the load pin to suit.

The Single-Sheave Dynamometer with integral Load Pin is usually rigid-mounted on a suitable location at the boom tip section.

Drawing References:

DWG 1938 – "Dimensional Detail, RW1500 Load Pin"
DWG 0991 – "General Details, Single Sheave Dynamometer"

Typical installation of load pins in single sheave dynamometers

Anti-Two-Block (Optional Item)

Fix the anti-two-block (ATB) switch mounting bolt by welding it to the 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. Check that the switch works correctly as the boom luffs throughout its working range.

Additional switches (for fly-jibs) can be added. Connection is via the bullet-type connectors from the cable. When more than one ATB switch is required (e.g. main & fly), connect the ATB cables of the switches in series via the bullet-type connectors.

Hang the bob weight assembly from the switch eye after cutting the chain to length if desired to suit winch line speed. Repeat the procedure if required for rooster or fly jib.

Drawing References:
DWG 2934 – "Dimensional Detail, BB5 Anti-Two-Block Switch"
DWG 0667 (Sheet 3 of 3) – "ATB Switch Installation Details, Strut Boom"

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

Cabling (Boom Sensors)

Load, angle, and ATB cables should be fixed firmly to where they are installed and routed along the boom chords through to the crane cabin ensuring freedom of movement around the boom pivot pin.

The cables are normally quite robust. They should be treated with care, however, as even a small amount of damage can be very costly due to down-time or intermittent behaviour. Always support the cable in such a way that there is no "excessive" strain applied, such as tension or flexing. The cable should be strapped to a fixed member that it runs along, unless it is held within a cable tray or trunking. Clip cables at approximately 600mm intervals or where suitable to secure them firmly to the boom. Avoid sharp bends such as around a sharp corner. Where there is to be flexing, the installer must ensure that the bending is reduced to an absolute minimum to avoid fatigue breakage of the conductors.

Drawing Reference:
DWG 1244 – "RCI Series Cable Connections"

Connectors

It is recommended that the installer applies a suitable silicone grease (e.g., Dow Corning 4 “Electrical Insulating Compound” or any similar compound) on the plugs and sockets prior to connecting the cables. The silicone grease should be smeared across the connector contact points to increase the water proofing of the connector.

INSTALLING CABIN PARTS

Display Unit and Key Switch Box

Fit the RCI-1502 Display Unit and Key Switch Box in a convenient position in the crane cabin such that the operator can view the displays and reach the push buttons comfortably.

Connect the Switch Box power supply lead to the key start switch or directly to the battery via a relay that is energised by the key start switch. Ensure that the polarity of the power supply is correctly connected.

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.

Connect the load, angle, and anti-two-block ATB cables to the display unit.

Note: If a good earth connection between the mounting bracket and the cabin cannot be guaranteed then the earthing wire attached to the base of the display must be used to properly earth the display. Failure to do so could result in a non-operational ATB signal and faults due to Radio Frequency Interference.

Drawing References:
DWG 0279 – “Dimensional Drawing, RCI-1502 Display”
DWG 2459 – “Dimensional Detail, RCI-1502 Switchbox”
DWG 3336 – “RCI-1502 Switchbox V2 Wiring Diagram”

Display unit and typical installation inside the cabin

WIRING SLEW SWITCH/ES AND MOTION CUT OUTPUT

Slew/Proximity Switch/es (Optional Items)

The slew switch is used when the crane has different zones of SWL (e.g. over-rear ratings, over-side ratings, etc.). The switch will convey a signal to the display when the crane moves into a zone of different capacity rating. The RCI-1502 system can interface with up to three switches maximum.

The switch is magnetically switched and requires a metal target to switch ON. Fabricate, fix and secure a suitable mounting plate to the switch between the two locknuts supplied. Mount the plate/switch assembly at a suitable location on the revolving upperstructure preferably so that the switch moves and rotates with the upperstructure. The metal target plate must be mounted at a safe and suitable location on the carrier about which the upperstructure rotates.

Alternatively, fix the switch and target plate around the centre post of the crane slew (refer to typical installation photo below).

The gap between the switch and target must not exceed 10mm. The switch distance can be adjusted via the locknuts.

Connect the switch to the RCI-1502 Switchbox as per DWG 3336 (refer to Section 8.2. “Drawings” for details).

Drawing References:
DWG 2461 – “Dimensional Details, Proximity Switch (SWIPROX02)”
DWG 2462 – “Dimensional Details, Proximity Switch (SWIPROX03)”
DWG 930050 – “RCI Slew Switch Mounting”

Typical installation of slew/proximity switch

Motion Cut Output

The standard RCI-1502 Switchbox has an in-built relay to output the motion-cut signal. This allows connection of the crane’s lockout solenoids direct into the Switchbox.

The Switchbox is fitted with a standard 24VDC (contact rating of 10A) relay when supplied from the factory. A spare 12VDC (contact rating of 10A) relay is also supplied with the installation kit supplied with the system. This is to replace the 24VDC relay if the crane’s nominal supply is 12VDC.

To wire the crane’s lockout solenoids, open the RCI-1502 Switchbox and use the following relay connections to match the solenoids:

Relay Terminal No.	Contact Output Description
3	Normally Open
4	Common
5	Normally Closed

The lockout solenoids on cranes are normally energised when crane is in safe condition (no alarm) and are de-energised when a motion cut condition occurs. Use contact terminals 4 (com) and 5 (NC) of the motion cut relay to wire the supply coil of the lockout solenoids. During motion cut activation, the motion cut relay is de-energised. This opens the relay contacts and also de-energises the lockout solenoids.

The Switchbox has a spare gland for motion cut cable entry. Please note that the motion cut cable is not supplied with the RCI-1502 System as a standard component.

Drawing Reference:
DWG 3336 – "RCI-1502 Switchbox V2 Wiring Diagram"

5. Calibration

WARNING

Calibration by untrained personnel may result in corruption of sensitive calibration data. Therefore, entry into calibration routines should only be performed by trained personnel.

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-1502 Switchbox 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 of at least 100 ft. long (30.5m) for verifying radius,
- Known test weight of at least 75% of the hoist rope single linepull for calibrating the heavy load,

  Note: For twin winch cranes, two test weights may be required, one for each winch if different linepulls.

- Software configuration sheets and function codes list provided at the back of this manual.

Map of Calibration (Suggested Order):

1. Set date and time (F-32 to F-34).

2. Verify that raw counts stay within 33-999 for full working range of all sensors (F-07, F-15, F-19). F-19 is only required for twin winch cranes.

3. Review all crane geometry against the supplied Crane Configuration settings for correctness (F-45 to F-53) – refer also to Section 8.4. “RCI System Crane Configuration Sheet / Duty Listing” at the rear of the manual for factory default settings.

4. Review all SWL % parameters against actual requirements (F-42 to F-44) and change if required – refer also to Section 8.4. “RCI System Crane Configuration Sheet / Duty Listing” at the rear of the manual for factory default settings.

5. Review the data logger recording points against actual requirements (F-61 to F-67) and change if required – refer also to Section 8.4. “RCI System Crane Configuration Sheet / Duty Listing” at the rear of the manual.

6. Check Metric/Imperial units switching and set to required unit of measure. Use function code (F-72) if single winch crane, or code (F-75) if twin winch crane.

7. Calibrate low & high boom angle sensor (F-09, F-10).

8. View and check accuracy of the calibrated angle value in degrees on function code (F-08).

9. Calibrate light and heavy main winch load (F-02, F-03).

10. View and check accuracy of the calibrated Main load value in tonnes or kips, whichever “unit” is selected on item #6 above, using function code (F-01).

11. Calibrate light and heavy aux. winch load (F-05, F-06) – if twin winch crane.

12. View and check accuracy of the calibrated Aux. load value in tonnes or kips, whichever “unit” is selected on item #6 above, using function code (F-04) – if twin winch crane.

13. Apply averaging of samples, if required, using function code (F-27). Default value is 0 and maximum setting is 25. Try different value settings to stabilise the load readout if necessary. Refer to Section 5.2.18. for details.

14. Apply load/angle correction factor, if required, using function codes (F-68 to F-70) if single winch crane, or (F-68 to F-71) if twin winch crane. Refer to Section 5.6. “Using Load/Angle Correction Function” for details and procedures.

15. Set the rigging SWL, if required, using function using code (F-71) if single winch crane, or (F-72 to F-73) if twin winch crane. Refer to Section 5.2.33. “Main Winch Rigging SWL” and 7.2.34. “Aux Winch Rigging SWL” for details.

16. Once satisfied with the calibration results, manually record (pen & paper) the calibration data using function code (F-40) and all settings mentioned above. Refer to Section 5.7. “Copying & Restoring Calibration Data Function” for details and procedures.

5.1. Verifying Operation of Sensors

Before you start calibrating the RCI-1502, you must make sure that the sensors are working correctly and their signals are reaching the RCI-1502.

The RCI-1502 'sees' the crane and its surroundings through sensors. The signals from these sensors are represented as numbers inside the RCI-1502. The range of possible numbers is 0 to 1023 for each sensor.

The RCI-1502 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-1502 (refer to Section 6. “Troubleshooting”).

If the signal is less than 32, suspect a short circuit somewhere on that input channel, e.g. the cable to the RCI-1502 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-1502 will report an error and activate motion cut. To prevent this you can press the ENTER key, while in "VIEW UNCALIBRATED 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.

5.2. 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-1502 at the time of manufacture. As this information may vary from crane to crane, even if they are of the same model, the RCI-1502 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 8.4. “RCI System Crane Configuration Sheet / Duty Listing” at the rear 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-1502 indicator. Therefore the values of the user variables must be checked and corrected if necessary before proceeding with further calibration or operation.

5.2.1. Exit Calibration Mode (F-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.

5.2.2. View Calibrated Main Load (F-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.

5.2.3. Calibrate Light Main Load (F-02)

Please see Section 5.4.1. “Calibrating Light Main Load” for details.

5.2.4. Calibrate Heavy Main Load (F-03)

Please see Section 5.4.2. “Calibrating Heavy Main Load” for details.

5.2.5. View Calibrated Aux Load (F-04) – For Twin Winch Cranes Only

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.

5.2.6. Calibrate Light Aux Load (F-05) – For Twin Winch Cranes Only

Please see Section 5.5.1. “Calibrating Light Aux Load” for details.

5.2.7. Calibrate Heavy Aux Load (F-06) – For Twin Winch Cranes Only

Please see Section 5.5.2. “Calibrating Heavy Aux Load” for details.

5.2.8. View Uncalibrated Angle Input (F-07)

Use this function to view the raw counts (or raw data) of the angle sensor. Please also Section 5.1. “Verifying Operation of Sensors” for details.

5.2.9. View Calibrated Angle Input (F-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.

5.2.10. Calibrate Low Angle (F-09)

Please see Section 5.3.1. “Calibrating Low Boom Angle” for details.

5.2.11. Calibrate High Angle (F-10)

Please see Section 5.3.2. “Calibrating High Boom Angle” for details.

5.2.12. Function Codes (F-11 to F-14) – Not Used

These function codes are used for telescopic cranes only.

5.2.13. View Uncalibrated Transducer 1 Input (F-15)

Use this function to view the raw counts (or raw data) of the Main Load transducer (main load sensor). Please also Section 5.1. “Verifying Operation of Sensors” for details.

5.2.14. Function Codes (F-16 to F-18) – Not Used

These function codes are used for Load Moment-based systems only.

5.2.15. View Uncalibrated Transducer 2 Input (F-19) – For Twin Winch Cranes Only

Use this function to view the raw counts (or raw data) of the Aux Load transducer (aux load sensor). Please also Section 5.1. “Verifying Operation of Sensors” for details.

5.2.16. Function Codes (F-20 to F-22) – Not Used

These function codes are used for Load Moment-based systems only.

5.2.17. Function Codes (F-23 to F-26) – Not Used

These function codes are used for model RCI-4000IS System only.

5.2.18. Number of Sensor Samples to Average (F-27)

This function is used to stabilise the display in the event that the numbers (readouts during normal operating mode) are changing erratically. Function code F-27 will show the number of samples currently being used to average the sensor inputs. This value can be edited by using the Up/Down buttons. Default setting is “0” and the maximum selectable value is “25”. Try different settings until the readouts are stable.

5.2.19. Function Code (F-29) – Not Used

This function code is used for telescopic cranes only.

5.2.20. Load Chart View Mode (F-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.

5.2.21. View Digital Inputs (F-31)

This function code is used to view the state (i.e. open or closed) of the three digital inputs (A, B, & C) on the RCI-1502. The inputs are used for wiring the slew/proximity switches if the crane has different zones of SWL. This function is useful when troubleshooting the input signals from the switches to the display, i.e. if the value changes when the switches are switched on and off. The values are as follows:

Digital Input: C-AB (Note: The I/O state of input C is different from A & B)

0-11 All switches (A, B, & C) open
0-01 A closed, B & C open
0-10 B closed, A & C open
1-11 C closed, A & B open
0-00 A & B closed, C open

5.2.22. Set Year (F-32)

Use this function to set the current year.

5.2.23. Set Day and Month (F-33)

Use this function to set the current day and month.

5.2.24. Set Time (F-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.

5.2.25. Download Logger Contents to PC (F-35)

Please see Section 8.1. "Data Logging on RCI Systems" at the rear of the manual for details.

5.2.26. Erase Logger Contents (F-36)

Please see Section 8.1. "Data Logging on Robway RCI's" at the rear of the manual for details.

5.2.27. Alter Calibration Data (F-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 5.7. "Copying & Restoring Calibration Data Function" for details and procedures.

5.2.28. Clear All Calibration Data (F-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.

5.2.29. User Variables (SWL % Alarms, Motion Cut)

Function codes **(F-42 to F-44)** are used to set the Safe Working Load (SWL) percentages for activating Visual and Audible Alarms as well as the Motion Cut control output. The preset or factory default values are based on standard safe parameter settings and may be used. These values can be edited and changed using these functions codes to suit requirements.

5.2.30. User Variables (Crane Geometry)

Function codes **(F-45 to F-53)** 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 using these function codes.

5.2.31. User Variables (Data Logging Setup Parameters)

Function codes **(F-61 to F-67)** are user variables relating to the setup prameters of the internal data logger. Please see also Section 8.1. “Data Logging on RCI Systems” at the rear of the manual for details.

5.2.32. Load / Angle Correction: (F-68 to F-70) – For Single Winch Cranes (F-68 to F-71) – For Twin Winch Cranes

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 5.6. “Using Load/Angle Correction Function” for details.

Please refer to Section 8.3. “Function Codes” at the rear of this manual for the applicable set of codes. Two sets of codes have been provided in Section 8.3. One is for Single Winch cranes and the other is for Twin Winch cranes.

5.2.33. Main Winch Rigging SWL: (F-71) – For Single Winch Cranes (F-72) – For Twin Winch Cranes

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.

Please refer to Section 8.3. “Function Codes” at the rear of this manual for the applicable set of codes. Two sets of codes have been provided in Section 8.3. One is for Single Winch cranes and the other is for Twin Winch cranes.

5.2.34. Auxiliary Winch Rigging SWL (F-73) – For Twin Winch Cranes Only

This function applies to Twin Winch cranes only and is the same function as the Main Winch Rigging SWL (refer to Section 5.2.33.) but for the Aux Winch.

Please refer to Section 8.3. “Function Codes” at the rear of this manual for the applicable set of codes. Two sets of codes have been provided in Section 8.3. One is for Single Winch cranes and the other is for Twin Winch cranes.

5.2.35. Auxiliary Hook Block Allowance While Lifting on Main Winch (F-74) – For Twin Winch Cranes Only

Normally, the system goes on alarm when either the Main or Aux winch has reached its maximum radius. On some cranes, the Main winch may be used to operate up to its maximum radius limit even when the Aux winch has already reached its maximum radius. To allow the Main winch to operate this way, enter the weight of the Aux hook block to this function code.

Please refer to Section 8.3. "Function Codes" at the rear of this manual for the applicable set of codes. Two sets of codes have been provided in Section 8.3. One is for Single Winch cranes and the other is for Twin Winch cranes.

5.2.36. Metric/Imperial Units Switching: (F-72) – For Single Winch Cranes (F-75) – For Twin Winch Cranes

Use this function to select the required unit of measure (Metric or Imperial). Factory default setting is "Metric".

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

Please refer to Section 8.3. "Function Codes" at the rear of this manual for the applicable set of codes. Two sets of codes have been provided in Section 8.3. One is for Single Winch cranes and the other is for Twin Winch cranes.

5.3. Calibrating Boom Angle

5.3.1. 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 (F-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.

5.3.2. 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 (F-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.

5.4. Calibrating Load on the MAIN Winch

5.4.1. Calibrating Light Main Load

- Safely lift a light, known test load off the ground, the load should be heavy enough to produce approximately 10% of the maximum single linepull of the main winch (or if not available, just lift the empty main hook block),

- Enter calibration mode, if not already activated, and select the correct function code (F-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. the total weight of the light load lifted (or if not available, the weight of the empty main hook block),

- Press ENTER to accept value. Proceed to next Section 5.4.2. “Calibrating Heavy Main Load”.

5.4.2. Calibrating Heavy Main Load

- Safely lift a heavy, known test load off the ground, the load should be heavy enough to produce approximately 75% of the maximum single linepull of the main winch,

- Enter calibration mode, if not already activated, and select the correct function code (F-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. the total weight of the heavy load lifted (including the weight of the main hook block and all rigging accessories used),

- Press ENTER to accept value. For Twin Winch cranes, proceed to Section 5.5. “Calibrating Load on the Aux Winch”.

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

5.5. Calibrating Load on the AUX Winch – If Twin Winch Crane

5.5.1. Calibrating Light Aux Load

- Safely lift a light, known test load off the ground, the load should be heavy enough to produce approximately 10% of the maximum single linepull of the aux winch (or if not available, just lift the empty aux hook block),

- Enter calibration mode, if not already activated, and select the correct function code (F-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. the total weight of the light load lifted (or if not available, the weight of the empty aux hook block),

- Press ENTER to accept value. Proceed to next section 5.5.2. “Calibrating Heavy Aux Load”.

5.5.2. Calibrating Heavy Aux Load

- Safely lift a heavy, known test load off the ground, the load should be heavy enough to produce approximately 75% of the maximum single linepull of the aux winch,

- Enter calibration mode and select the correct function code (F-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. the total weight of the heavy load lifted (including the weight of the aux hook block and all rigging accessories used),

- Press ENTER to accept value.

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

5.6. 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 the following Calibration Function Code routines as follows:

Low Angle for Load Correction (F-68)
High Angle for Load Correction (F-69)
Load / Angle Correction Factor for Main Winch (F-70)
Load / Angle Correction Factor for Aux Winch (F-71) – Applies to Twin winch cranes only

These function codes allow the operator to enter the luffing range (F-68 & F-69) of the crane and a change in the load (F-70 & F-71) that is observed over this range.

The *Low Angle* (factory default value of 0 deg.) you enter should be the lowest angle the crane can actually luff to in operation. Similarly the *High Angle* (factory default value of 90 deg.) should be set to the highest angle the crane can be luffed to.

How to Calculate the Load / Angle Correction Factor (F-70 & F-71)
The number entered here is a correction value, when this number is 0.0 (factory default setting) no correction is being applied (ie. 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 **(F-70 for Main and F-71 for Aux, if twin winch crane)** 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* (F-70) should be entered as 5.3 t.
- Repeat the same procedure on the Aux winch (F-77), if crane is twin winch.

5.7. Copying and Restoring Calibration Data Function

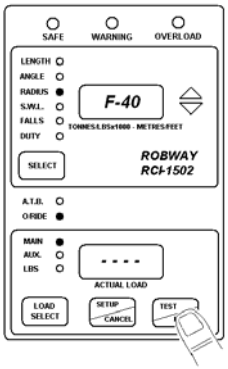
The latest software for the model RCI-1502 features a facility to easily VIEW, COPY, and RESTORE Calibration Data by using function code **F-40 "Alter Calibration Data"**.

Procedures in Recording/Copying Calibration Data:

1. Access Calibration Mode.

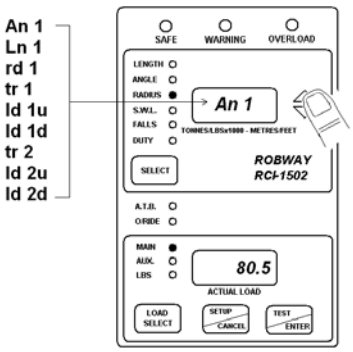
2. Activate function code **F-40 (Alter Calibration Data)**.

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



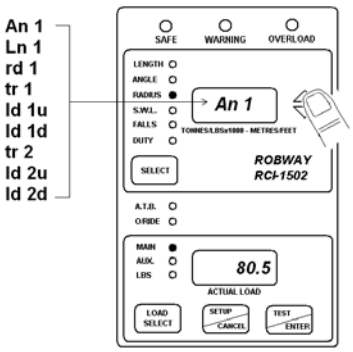
4. Function **An1 (Angle Channel)** will be displayed on top window. An1 is the default item that comes up whenever F-40 (Alter Calibration Data) is activated.

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



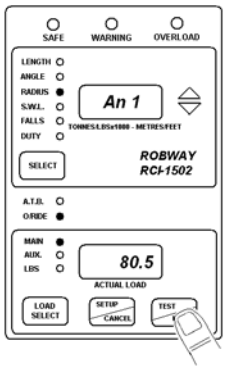
6. Use the Up/Down Arrow keys to go through all the following items listed below.

Codes	Description
An1	**Angle**
Ln1	Boom Length
rd1	Radius
tr1	Transducer 1
ld1u	Load 1 (or Main Load) Up
ld1d	**Load 1 (or Main Load) Down**
tr2	Transducer 2
ld2u	Load 2 (or Aux Load) Up
ld2d	**Load 2 (or Aux Load) Down**

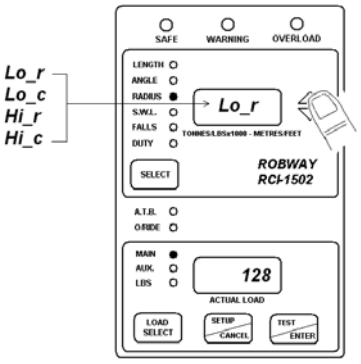


7. Only the "highlighted" items above must be copied (note: "ld2d" is the Aux loadcell channel and must only be copied if the Aux Winch is used). To copy an item, select the item and press the ENTER key.

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

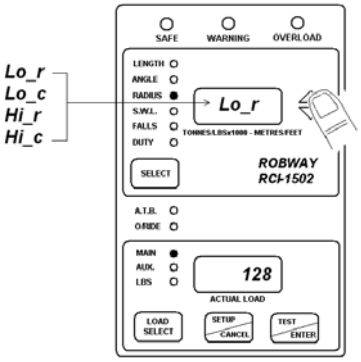


9. Press ENTER key while on the selected item (e.g. An1) to activate the Edit Codes. There are four (4) Edit Codes as follows:



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)

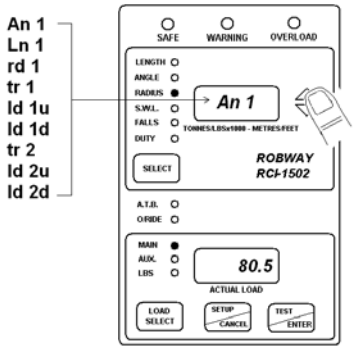
10. The first Edit Code is **Lo_r** which refers to the **raw counts or raw data of the calibrated low angle** (e.g., 128 counts as shown in this example).



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.

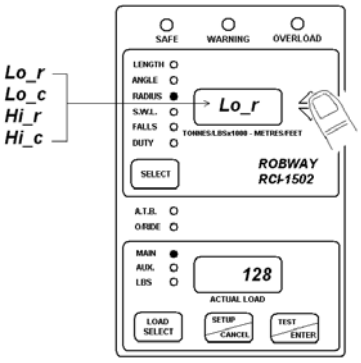


14. Select the next item, **ld1d**, and repeat above procedures 6 to 13. Select and repeat the same on **ld2d** if Aux Winch is used (i.e. if crane is Twin Winch).

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

    An1
    Id1d
    Id2d (if Aux Winch is used)

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).

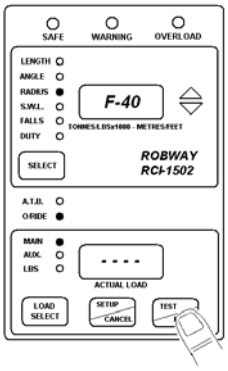


Procedures in Editing & Restoring Calibration Data:

1. Access Calibration Mode.

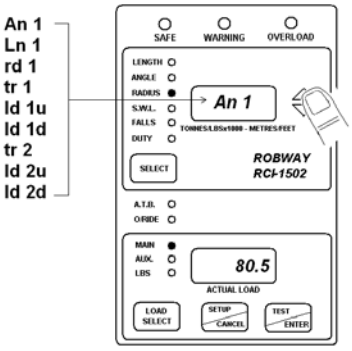
2. Activate function code **F-40 (Alter Calibration Data)**.

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



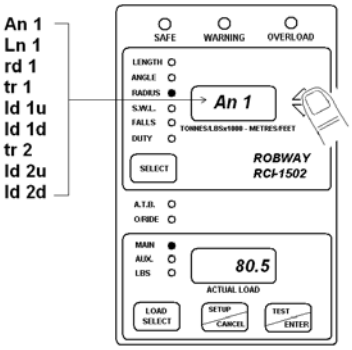
4. Function **An1 (Angle Channel)** will be displayed on top window. **An1** is the default item that comes up whenever F-40 (Alter Calibration Data) is activated.

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



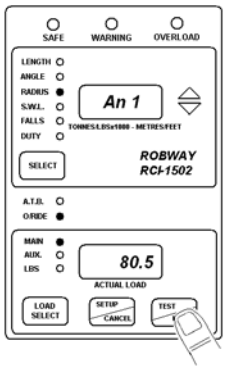
6. Use the Up/Down Arrow keys to go through all the following items listed below:

Codes	Description
An1	**Angle**
Ln1	Boom Length
rd1	Radius
tr1	Transducer 1
ld1u	Load 1 (or Main Load) Up
ld1d	**Load 1 (or Main Load) Down**
tr2	Transducer 2
ld2u	Load 2 (or Aux Load) Up
ld2d	**Load 2 (or Aux Load) Down**

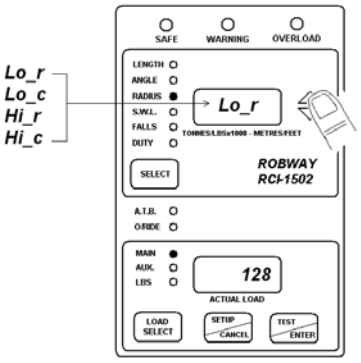


7. Only the "highlighted" items above must be restored (note: "ld2d" must only be restored if the Aux Winch is used). To restore an item, select the item and press the ENTER key.

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.

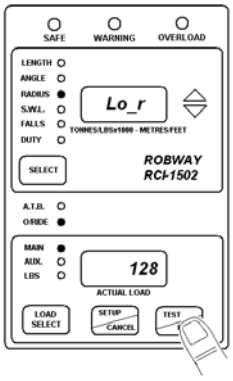


9. Use the Up/Down Arrow keys to go through the list of the four (4) Edit Codes as follows:



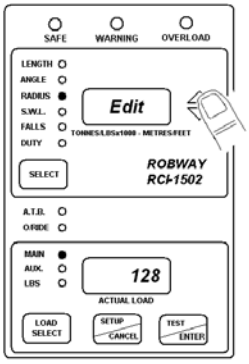
Edit Codes	**Description**
Lo_r	Raw Counts of Calibrated Data (Low End)
Lo_c	Calibrated Data (Low End)
Hi_r	Raw Counts of Calibrated Data (High End)
Hi_c	Calibrated Data (High End)

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).

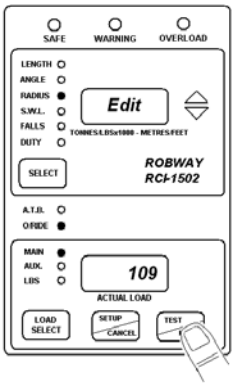


11. Press the ENTER key to access edit mode (i.e. the word “EDIT” comes up on the top window, or centre window if the system is an RCI-4000).

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

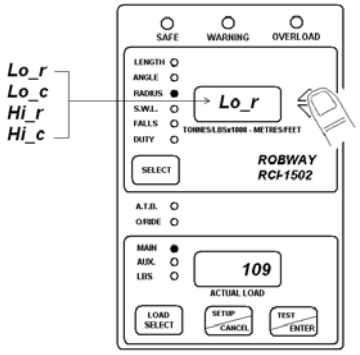


13. Press the ENTER key to store this new value to **Lo_r** (e.g. from 128 to 109 as shown in this example).



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).

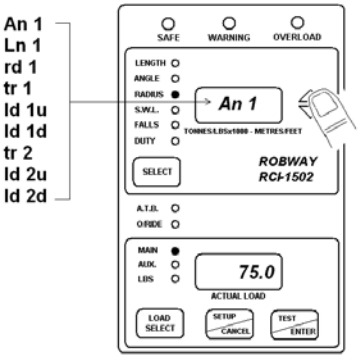


16. Once all of the Edit Codes for **An1** have been edited, press the CANCEL key to return to the **An1** screen.

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 (if Aux Winch is used)



6. Troubleshooting

The RCI-1502 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.

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 5. “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 4. “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 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 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.
- There is a load on the auxiliary winch in a duty that does not allow anything on that winch.
- 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.
- The number of falls selected is incorrect for the load being lifted, or does not match the actual falls reeved.

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.
- Wrong duty selected.
- 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.
- Wrong duty selected.
- 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.

You should check the power supply. The RCI-1502 has a voltage range of 10 – 40 vdc. If the supply is within range, open the Switchbox and check the fuses.

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

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

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.

7. Electrical Specifications

Power Supply Input (VDC)
Range: 10 VDC - 40 VDC

Power Consumption
< 1 amp (in full alarm)

Temperature Range
Operating: -20°C to +70°C

Digital Inputs
Total of three (3) digital inputs for connecting slew/proximity switches for monitoring different zones of operation, and/or for connecting other types of switches for any special crane requirement/application. Refer to Section 4. “Installation” of the manual for application details.

Motion Cut Relay Output
One (1) standard motion cut relay output available for wiring to crane lockout solenoids to inhibit crane motion when on overload/alarm condition. The relay fitted in the Switchbox is rated 10A @ 30 VDC. A spare 12 VDC relay is also supplied with the installation kit for use on 12 VDC cranes. Refer to Section 4. “Installation” of the manual for application details.

Sensors

Load Sensor/s

Capacity:	Various capacities to suit application
Excitation Voltage:	4.0 VDC regulated (provided by the Display unit)
Linearity:	0.15% nominal
Repeatability:	> 0.10%
Hysteresis:	< 0.10%
Creep:	< 0.10%
Output:	1, 2, or 3 mV/V nominal
Isolation:	> 2000 MOhms at 50 VDC
Overload:	150% (no electrical damage) > 400% (ultimate)
Temperature Effects:	
On Zero:	< 0.006% / °C
On Span:	< 0.005% / °C
Compensated Range:	-10°C to +70°C
Sealing:	IP68 fully encapsulated

Pin/Wire Connections:

Pin A	Black	Negative Excitation
Pin B	White	Negative Signal
Pin C	Red	Positive Excitation
Pin D	Green	Positive Signal
Pin E	Screen	Screen

Expected Resistances (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/Screen to any other wire must be open circuit

Electronic Angle Sensor

Excitation Voltage:	4.0 VDC regulated (provided by the Display unit)
Operating Range:	+/- 45° (offset mounted to accommodate 0 - 90°)
Accuracy:	+/- 0.2°
Cable Entry:	3-pin mil-spec type connector
Mounting:	Via backplate bracket to boom base
Weight:	0.5 kg

Pin/Wire Connections:

Pin A	Red	Positive Excitation
Pin B	White	Signal
Pin C	Black	Negative Excitation

Expected Resistances:

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

Proximity Switch

Type:	PNP – N.O. & N.C.
Sensing Range:	10 mm
Operating Voltage:	10 – 30 VDC
Switching Current:	200 mA maximum

Anti-Two-Block Switch (Model BB5)

Type:	V4 IP67 sealed, leaf
Contact Rating:	28 VDC/3A
Electrical Life:	10^5 operations
Operating Force:	0.6 N (max)
Release Force:	0.08 N (min)

Cables

General:	2-, 4-, 6-, & 10-core braided, UV stabilised, PVC sheathed cables
DC Resistance:	38.2 ohms/km @ 20°C (25.45 ohms/km for 2-core cable)
Core Insulation:	V90-HT PVC (designed to comply to AS/NZ 3808:2000)
Electrical Life:	10^5 operations
Cable Integrity:	All cores tested for insulation resistance @ test voltage of 500V
Sheath:	Overall 5V90 UV stabilised PVC
Current Rating:	3 amps
Capacitance:	150 pf/m (core to core)

8. Appendices

8.1. DATA LOGGING ON RCI SYSTEMS

8.2. DRAWINGS

8.3. RCI SYSTEM CRANE CONFIGURATION SHEET / DUTY LISTING / FUNCTION CODES

Appendix 8.1.

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

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.

- 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.

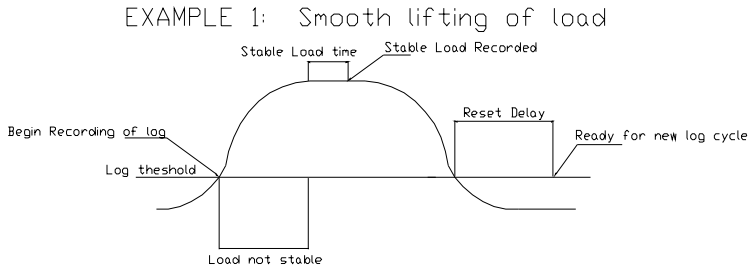
Because the crane is now back in a safe condition, a new logging cycle begins. When the driver finally puts this load down (assuming he does not luff off the chart again) the normal log cycle completes and another log is written to the logger.

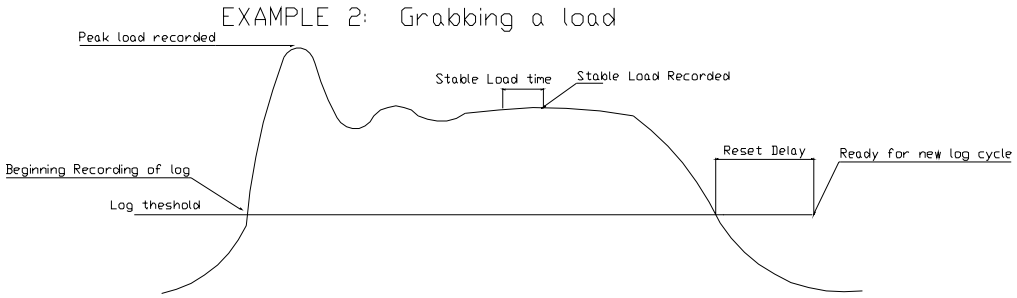
Hence, although the driver has lifted only a single load and luffed it to several positions, the actual load has been recorded a total of 4 times. This example serves to illustrate that if the crane is continually working on it's outer radius, the Logger will fill very quickly.

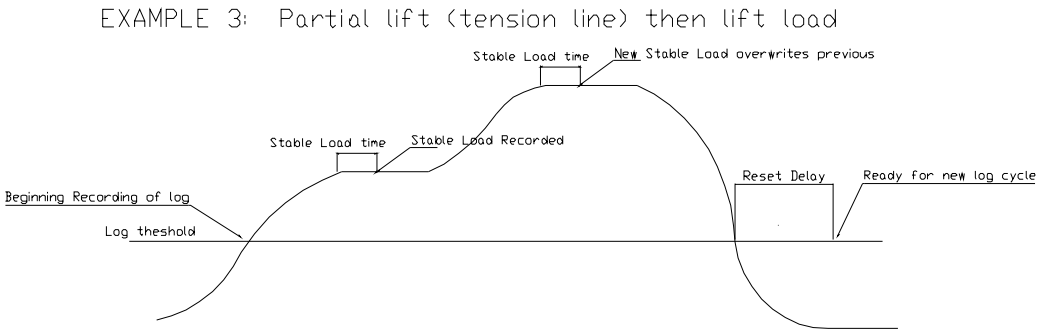
It should be noted that if motion cut is connected and the display is not in over-ride, luffing to the out radius limits of the load chart could cause the crane to oscillate as motion cut activates. In this case many logs may be recorded.

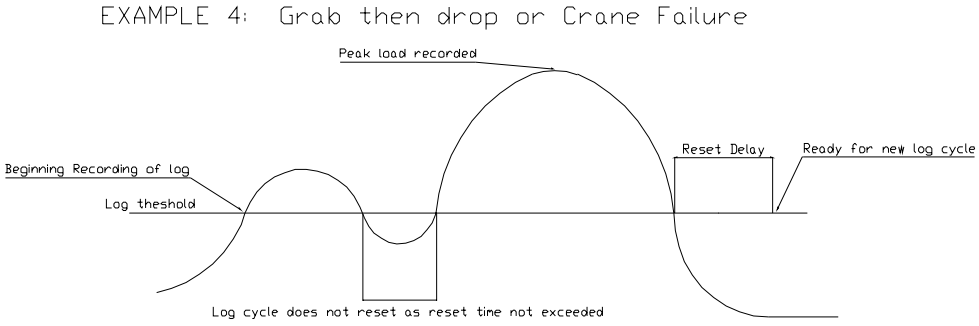
Data Logging on RCI Systems

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 8.2.

Drawings

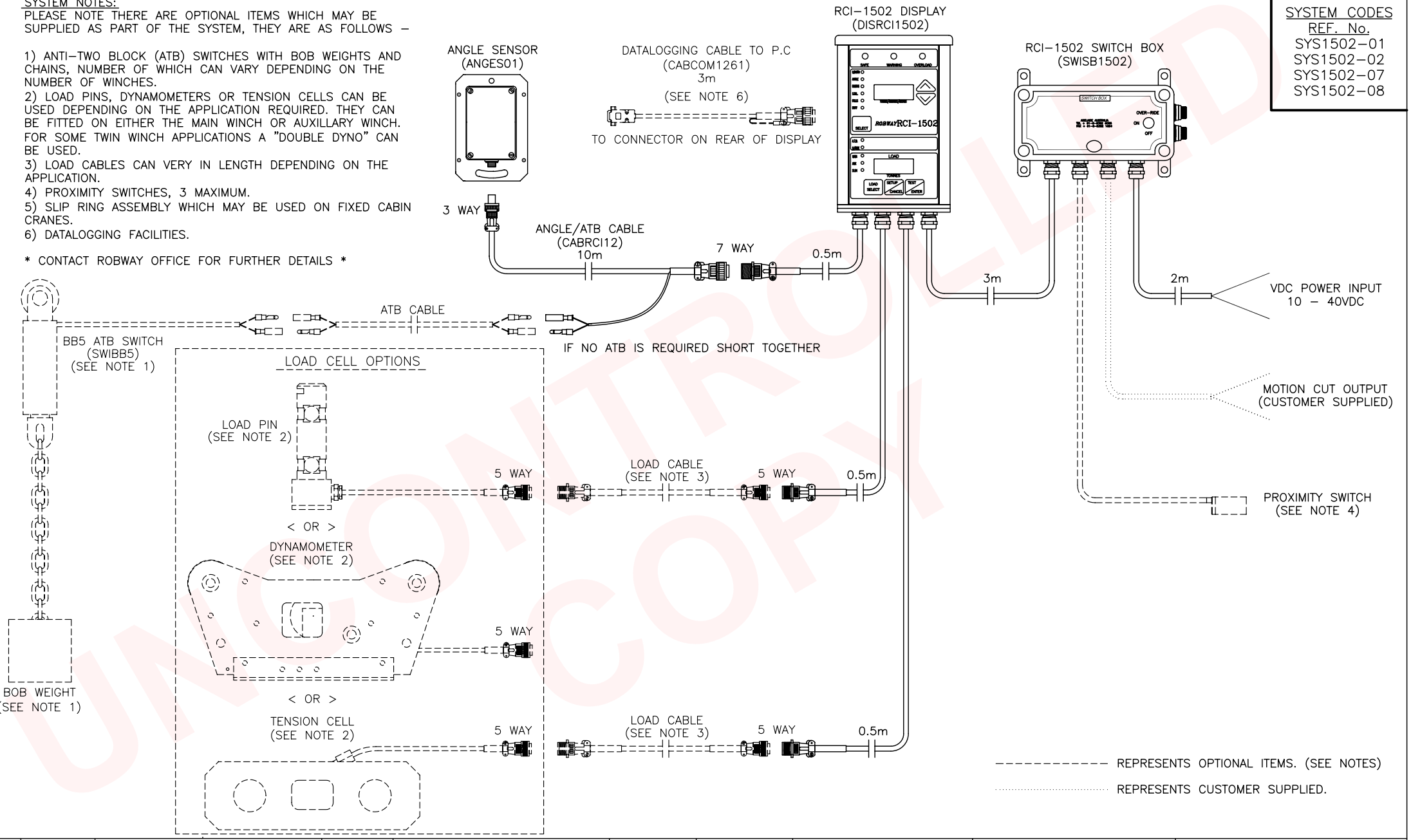
MAN1071C

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.
4) PROXIMITY SWITCHES, 3 MAXIMUM.
5) SLIP RING ASSEMBLY WHICH MAY BE USED ON FIXED CABIN CRANES.
6) DATALOGGING FACILITIES.

* CONTACT ROBWAY OFFICE FOR FURTHER DETAILS *

SYSTEM CODES
REF. No.
SYS1502–01
SYS1502–02
SYS1502–07
SYS1502–08



REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	04/06/04	STOCK–CODES ADDED	A.C.

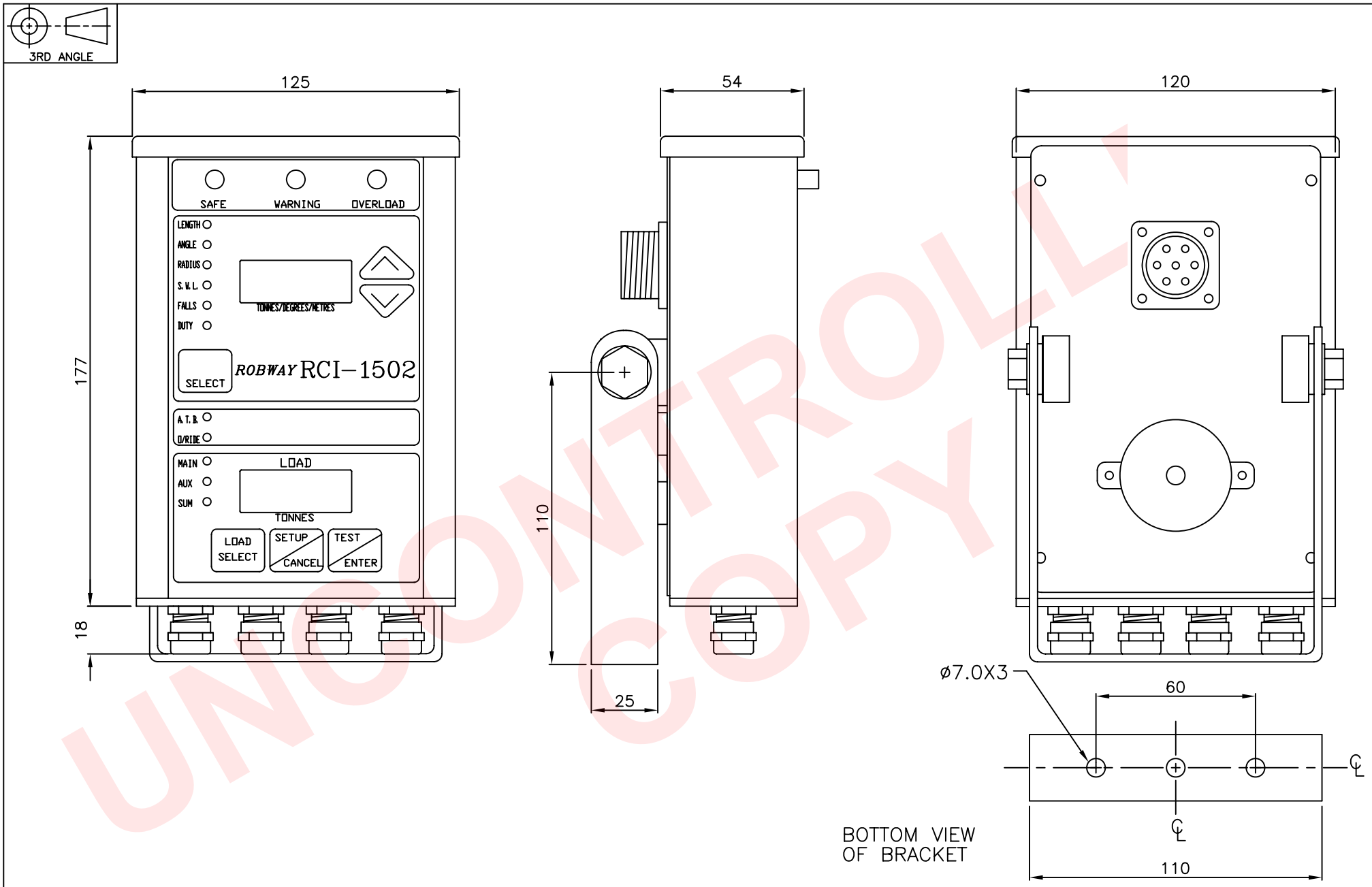
TOL: X. +/– 1
X.X +/– 0.2
X.XX AS STATED

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

DRAWN	APPROVED	PART OF ASSY
S. CHAMBERS	A. CANLAS	–
12/07/01	12/07/01	

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: –
TITLE: RCI–1502 GENERAL ARRANGEMENT FOR TYPICAL STRUT BOOM HOIST ROPE TENSION (HRT) SYSTEM
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 2466
FILE No: 246601AB.DWG
REV 1.1



REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.0	09/11/00	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		–
07/06/94		

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32 WEST THEBARTON RD
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 8352 6055
FAX +61 8 8352 1684

PART No: –

PROJECT: RCI–1502 DISPLAY

TITLE: DIMENSIONAL DETAILS

SCALE N/A

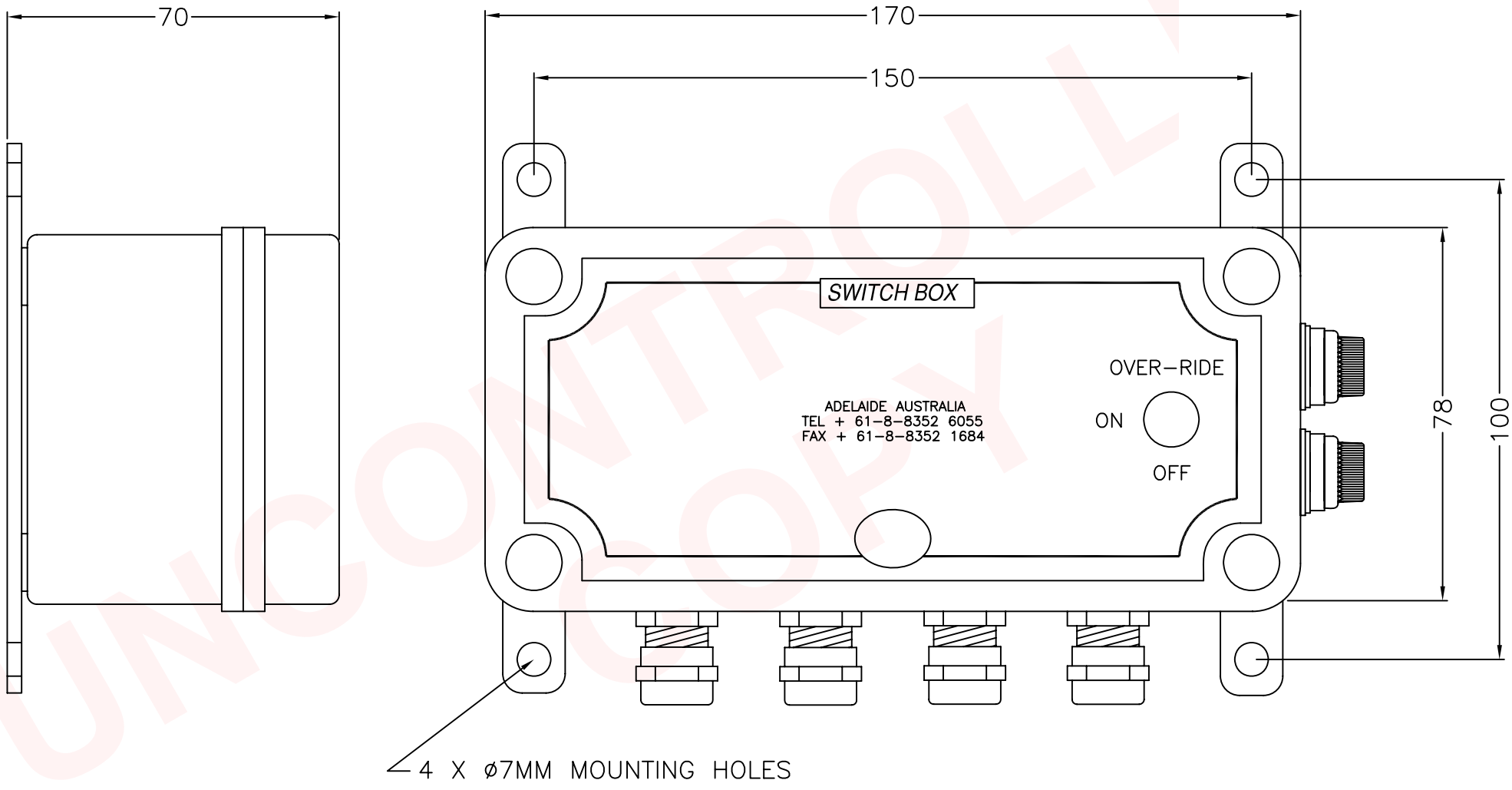
SHEET 1 OF 1

DRAWING No: DWG 0279

FILE No: 027901AA.DWG

REV 1.0

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	–
10/07/01	10/07/01	

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FAX +61 8 352 1684

PART No: –

PROJECT: RCI–1502 SWITCH BOX

TITLE: DIMENSIONAL DETAIL

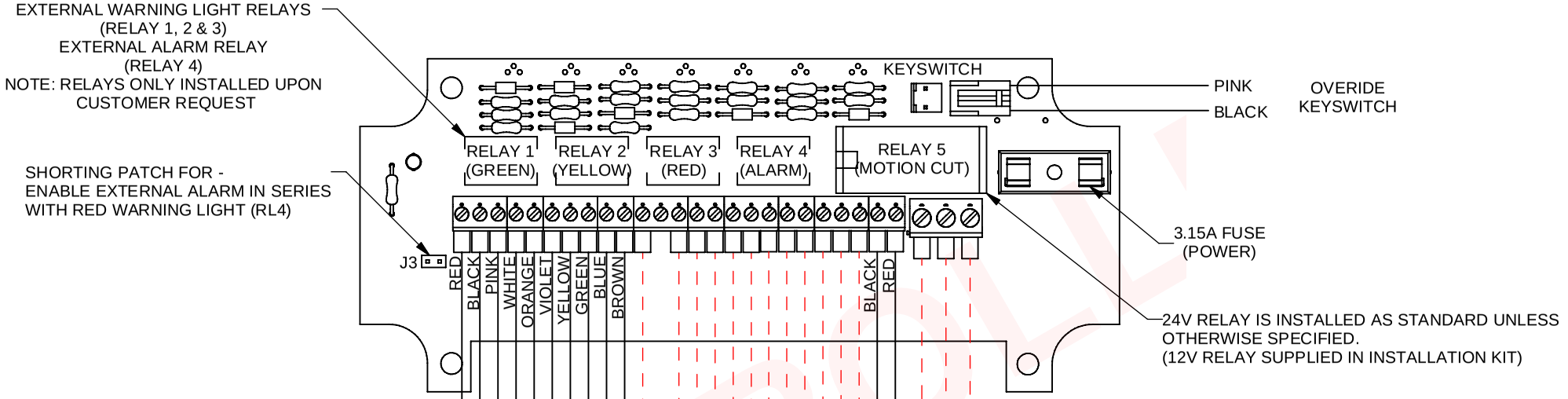
SCALE N/A

SHEET 1 OF 1

DRAWING No: DWG 2459

FILE No: 245901AA.DWG

REV 1.0



10 CORE DISPLAY INTERFACE CABLE

- POWER + (RED)
- POWER - (BLACK)
- OVERIDE (PINK)
- INPUT C (WHITE)
- INPUT B (ORANGE)
- INPUT A (VIOLET)
- MOTION CUT (YELLOW)
- BUZZER (GREEN)
- SPARE (BLUE)
- SPARE (BROWN)

2 CORE CABLE
(VDC POWER INPUT)

- SUPPLY +VE (RED)
- SUPPLY -VE (BLACK)

CUSTOMER WIRED
(UNLESS OTHERWISE
REQUESTED)

- MOTION CUT (N/C)
- MOTION CUT (N/O)
- MOTION CUT (COMMON)
- EXTERNAL ALARM (N/O)
- EXTERNAL ALARM (COMMON)
- EXTERNAL WARNING LIGHT (RED)
- EXTERNAL WARNING LIGHT (YELLOW)
- EXTERNAL WARNING LIGHT (GREEN)
- EXTERNAL WARNING LIGHT (COMMON)
- SUPPLY +VE
- INPUT C
- INPUT B
- INPUT A
- SUPPLY -VE
- EXTERNAL AUDIBLE ALARM

INSTALLATION NOTES:

1.THE MOTION CUT OPTION IS RATED FOR 10A 30V MAX. ENSURE THAT THE SOLENOID DOES NOT EXCEED THIS RATING.
2. THE INPUTS MARKED AS "A", :B", AND "C" ARE GENERAL PURPOSE INPUTS. THEIR FUNCTION ARE DEFINED IN THE SOFTWARE DESPATCHED FOR A PARTICULAR APPLICATION. REFER TO THE CONFIGURATION SHEET IN THE MANUAL FOR THEIR DEFINITION.
3. PREVIOUS DEFAULT DEFINITION FOR THE INPUTS WERE:
 - INPUT "A": MAIN DIRECTION, CLOSED = DOWN.
 - INPUT "B": AUXILLARY DIRECTION, CLOSED = DOWN.
 - INPUT "C": SLEW SWITCH, GENERALLY OPEN PRODUCED A DE-RATING.
4. ALL SLEW SWITCHES MUST BE RATED AT 35V OR MORE TO AVOID DAMAGE TO THE SWITCH.

PROXIMITY SWITCH WIRING

SIGNAL DESCRIPTION	COLOUR (TYPICAL)	CONNECTION IN SWITCHBOX
SUPPLY +VE	BROWN	SUPPLY +VE
SIGNAL OUT	BLACK	INPUT "A", "B" OR "C"
SUPPLY -VE	BLUE	SUPPLY +VE

REV	DATE	DESCRIPTION OF CHANGE	APPRV'D

TOL: X. +/-1
X.X +/-0.2
X.XX +/-0.02

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

DRAWN BY	APPROVED BY	PART OF ASSY
S. CHAMBERS	J. KOVAL	-
7/02/2006	28/04/2006	

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Crane Load Instrumentation
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32 West Thebarton Rd
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SOUTH AUSTRALIA 5031
PHONE: +61 8 8238 3500
FAX: +61 8 8352 1684

PART No:	PROJECT:
SWISB1502V2	1502 SWITCHBOX (VERSION 2)

TITLE: WIRING DETAIL

SCALE: N/A

SHEET: 1 OF 1

DRAWING No:	FILE No:	REV
DWG 3336	333601AA.idw	1.0

3RD ANGLE

MAN1071C

7-WAY CONNECTOR		LENGTH/ANGLE AND ATB CABLE	REELING DRUM CONNECTOR	ANGLE CABLE WITH ATB	ANGLE CABLE
PIN	DESCRIPTION	COLOUR	COLOUR	COLOUR	COLOUR
A	EXCITATION +VE	RED	RED	RED	RED
B	LENGTH SIGNAL	BLUE	BLUE		
C	EXCITATION -VE	BLACK	BLACK	BLACK	BLACK
D	NOT USED	YELLOW	YELLOW		
E	ANGLE SIGNAL	WHITE	WHITE	GREEN	GREEN
F	ATB SIGNAL	GREEN	GREEN	RED (ATB)	
G	SCREEN	SCREEN	SCREEN	SCREEN/BLACK (ATB)	SCREEN

5-WAY LOAD CONNECTOR		
PIN	COLOUR	DESCRIPTION
A	BLACK	EXCITATION -VE
B	WHITE	SIGNAL -VE
C	RED	EXCITATION +VE
D	GREEN	SIGNAL +VE
E	SCREEN	SCREEN

3-WAY ANGLE CONNECTOR		
PIN	COLOUR	DESCRIPTION
A	RED	EXCITATION +VE
B	GREEN	ANGLE SIGNAL
C	BLACK	EXCITATION -VE

NOTE:
- FOR ANGLE CABLE WITH ATB, PIN 'B' IN THE 7-WAY CONNECTOR IS NOT CONNECTED
- FOR ANGLE CABLES ONLY PINS 'B', 'D' AND 'F' IN THE 7-WAY CONNECTOR ARE NOT CONNECTED

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
M. TURNER	M. OBST	—
25-10-96	27/02/97	

ROBWAY SAFETY SYSTEMS PTY LTD
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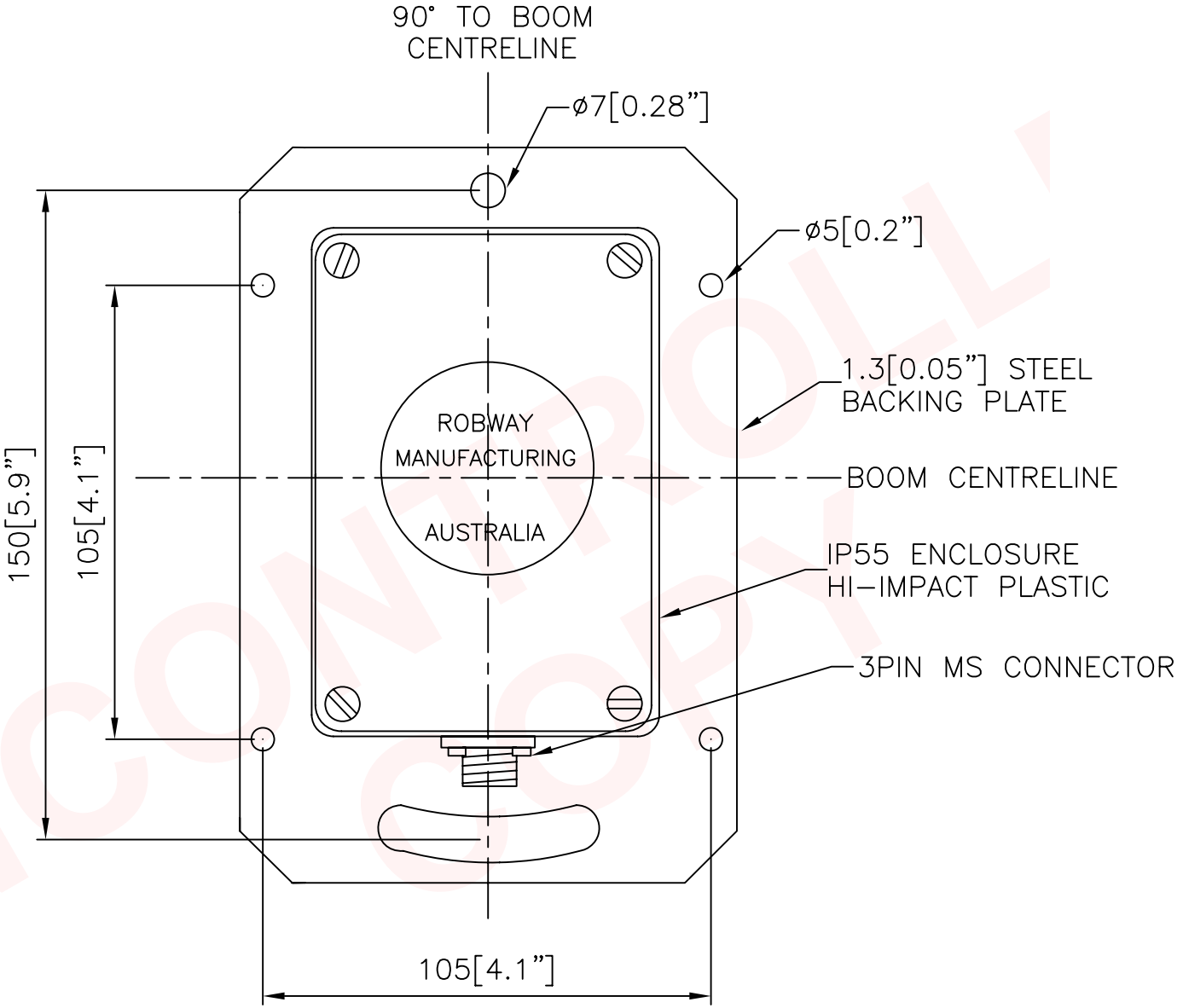
PART No: —
PROJECT: —
TITLE: RCI SERIES CABLE CONNECTIONS
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 1224
FILE No: 122401AA.DWG
REV 1.0

3RD ANGLE



REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	04/11/98	REFER TO DR#564	M.O.

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
M. TURNER	M. OBST	–
27/02/97	27/02/97	

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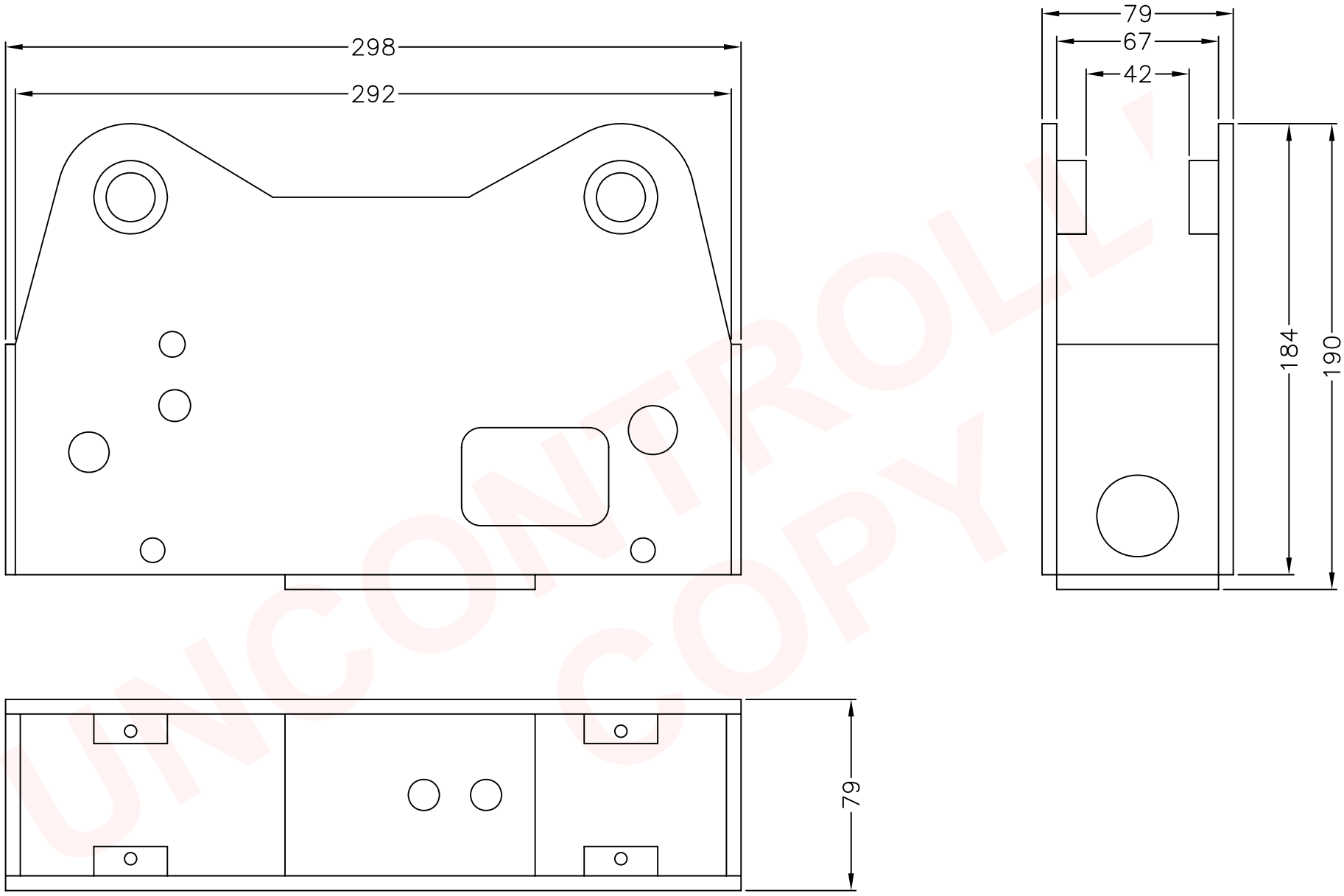
FAX +61 8 352 1684

PART No: –
PROJECT: –
TITLE: ELECTRONIC ANGLE SENSOR DIMENSIONAL DRAWING
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 1099
FILE No: 109901AB.DWG
REV 1.1



REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	28/05/98	REFER TO DR#451	

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
C. HOBBY	D.G.	—
10/09/97	10/09/97	

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

PART No: —

PROJECT: HRT3MM

TITLE: OVERALL DIMENSIONS

SCALE N/A

SHEET 1 OF 1

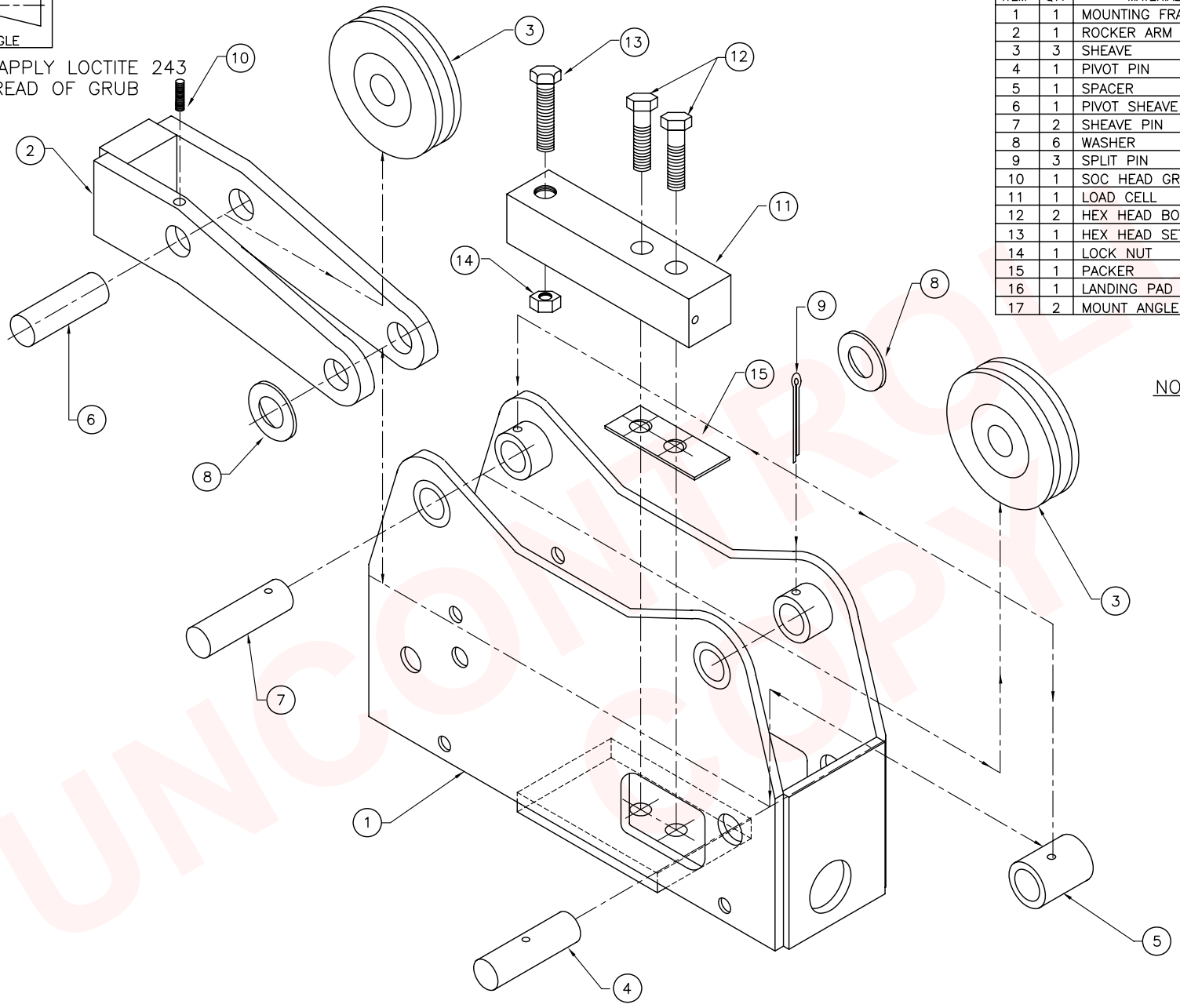
DRAWING No: DWG 1393

FILE No: 139301AB.DWG

REV 1.1

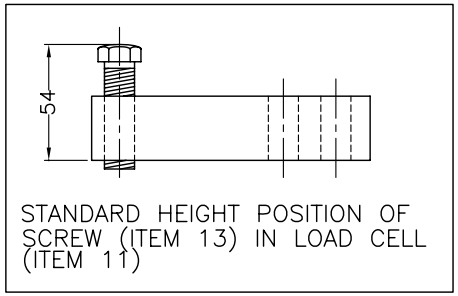
3RD ANGLE

NOTE: APPLY LOCTITE 243 TO THREAD OF GRUB SCREW.



ITEM	QTY	MATERIAL/DESCRIPTION	DWG No.	STOCK CODE (STANDARD)	STOCK CODE (MARINE S/S)
1	1	MOUNTING FRAME	DWG0885	FRADYNO1	FRAHRT3MMSS
2	1	ROCKER ARM	DWG0880	ROC3MM	ROC3MMSS
3	3	SHEAVE	DWG0892	SHEH3MM####	–
4	1	PIVOT PIN	DWG0882	SHAHRT01	–
5	1	SPACER	DWG0883	SPAHRT08	SPAHRT3MMSS
6	1	PIVOT SHEAVE PIN	DWG0881	SHAHRT03	–
7	2	SHEAVE PIN	DWG0882	SHAHRT02	–
8	6	WASHER	–	WAS20F	–
9	3	SPLIT PIN	–	PINCOTT03	–
10	1	SOC HEAD GRUB SCREW M6X20	–	SCRM620SG	–
11	1	LOAD CELL	–	CELBTD5P	–
12	2	HEX HEAD BOLT	–	BOL1213HHZP	–
13	1	HEX HEAD SET SCREW	DWG0287	SCR122CZP	–
14	1	LOCK NUT	–	NUT12HLZP	–
15	1	PACKER	DWG0884	PACHRT01	–
16	1	LANDING PAD	DWG0887	PADHRT01	–
17	2	MOUNT ANGLE BRACKET	DWG0886	BRAMHRT3MMU	BRAMHRT3MMSS

NOTE: ITEMS 16 & 17 ARE NOT SHOWN ON DRAWING



STANDARD HEIGHT POSITION OF SCREW (ITEM 13) IN LOAD CELL (ITEM 11)

STANDARD – DYNHRT3MM
MARINE S/S – DYNHRT3MMSS

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.2	11/01/96	REFER TO DR#125	M. OBST
1.3	11/02/97	REFER TO DR#229	M. OBST
1.4	28/05/98	REFER TO DR#451	M. OBST
1.5	29/03/99	REFER TO DR#551	D.P.
1.6	27/01/05	REFER TO DR#345	G.C.
1.7	01/08/05	REFER TO DR#409	S.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
ER	M. OBST	–
07/10/89	20/11/95	

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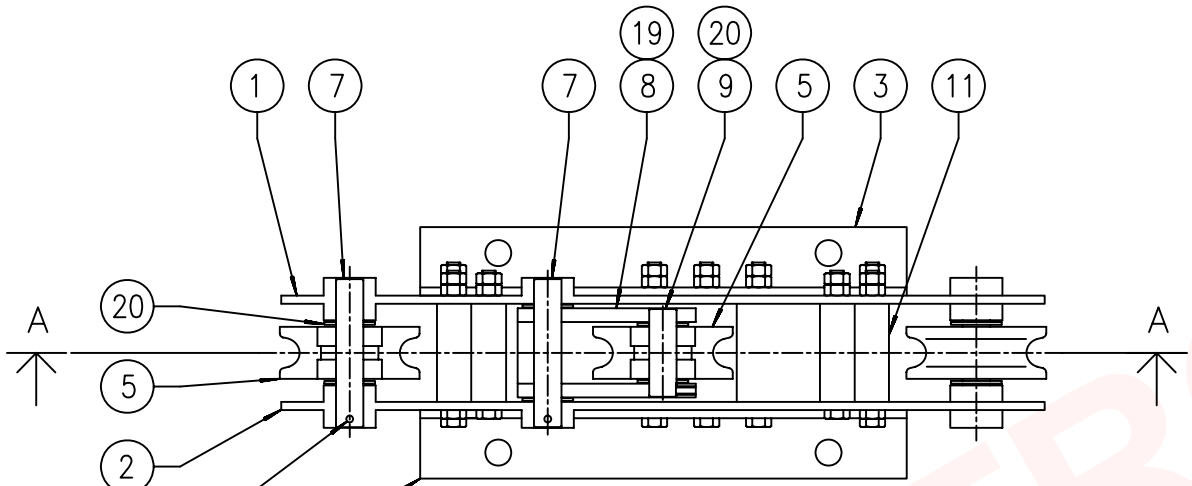
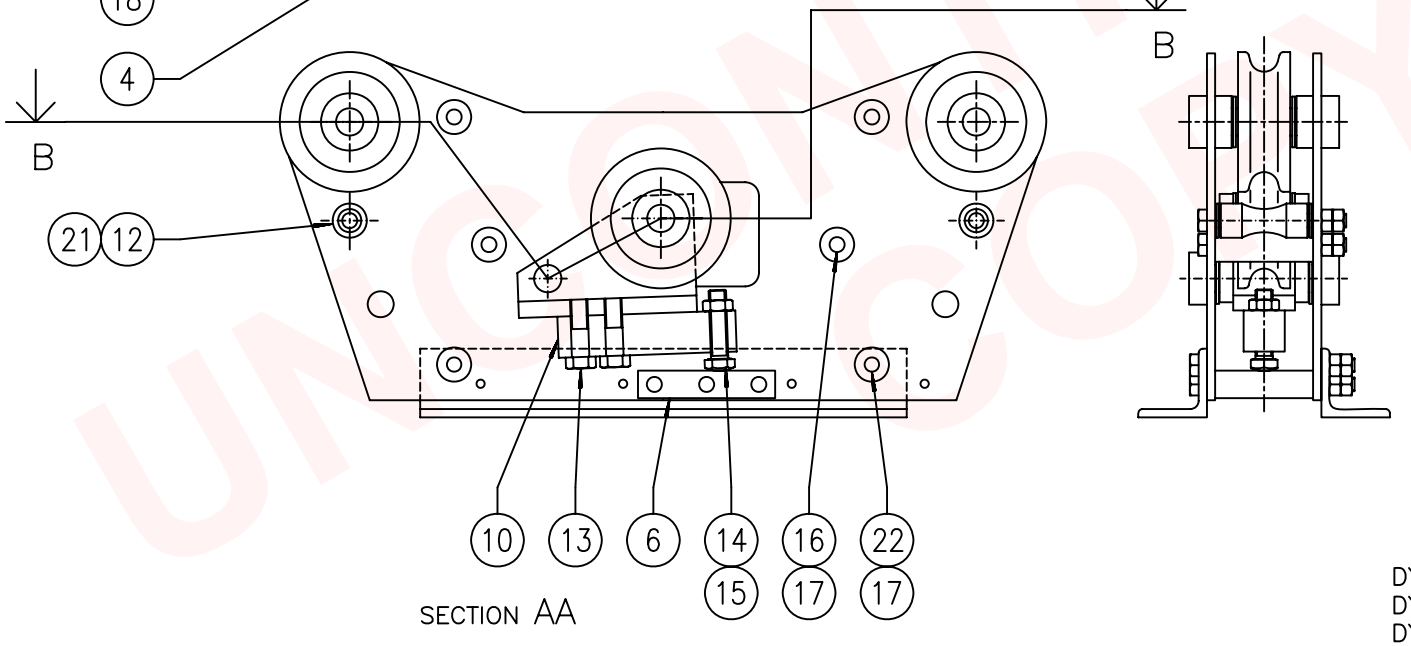
FAX +61 8 352 1684

PART No: SEE ABOVE
PROJECT: HRT–3MM DYNO
TITLE: GENERAL ARRANGEMENT
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 0875
FILE No: 087501AH.DWG
REV 1.7

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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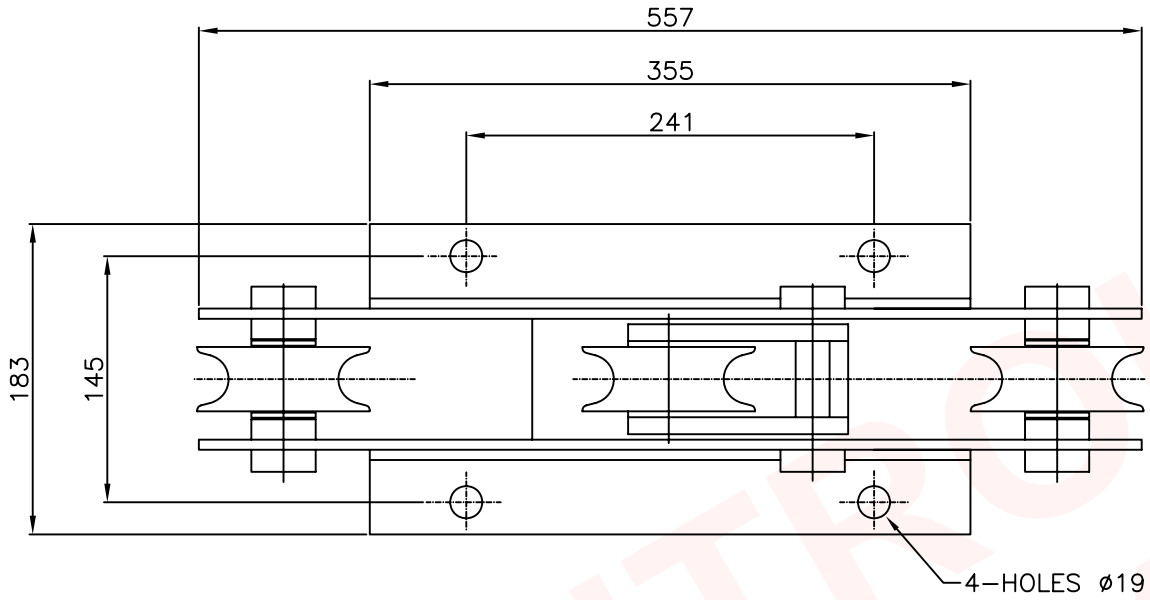
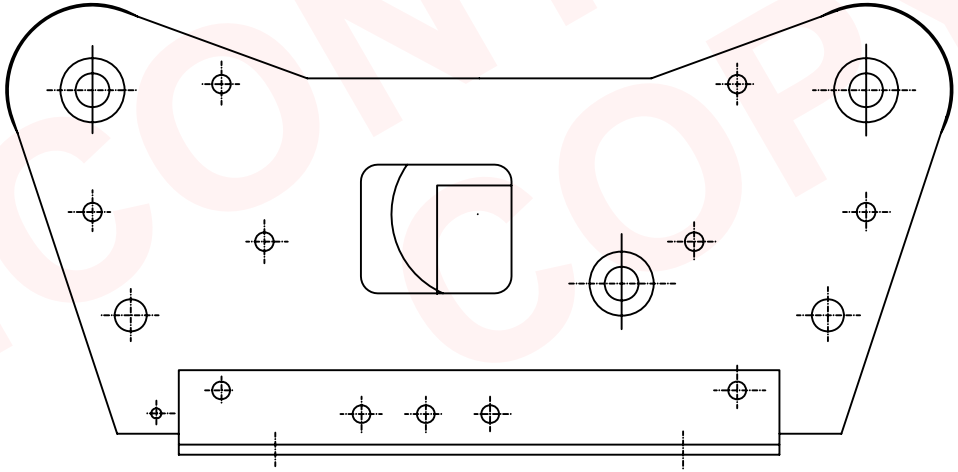
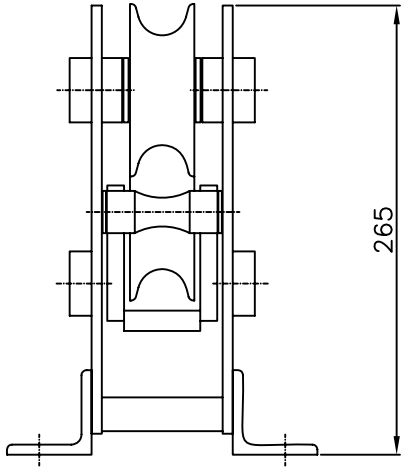
SOUTH AUSTRALIA
PHONE +61 8 8352 6055
FAX +61 8 8352 1684

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.
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	

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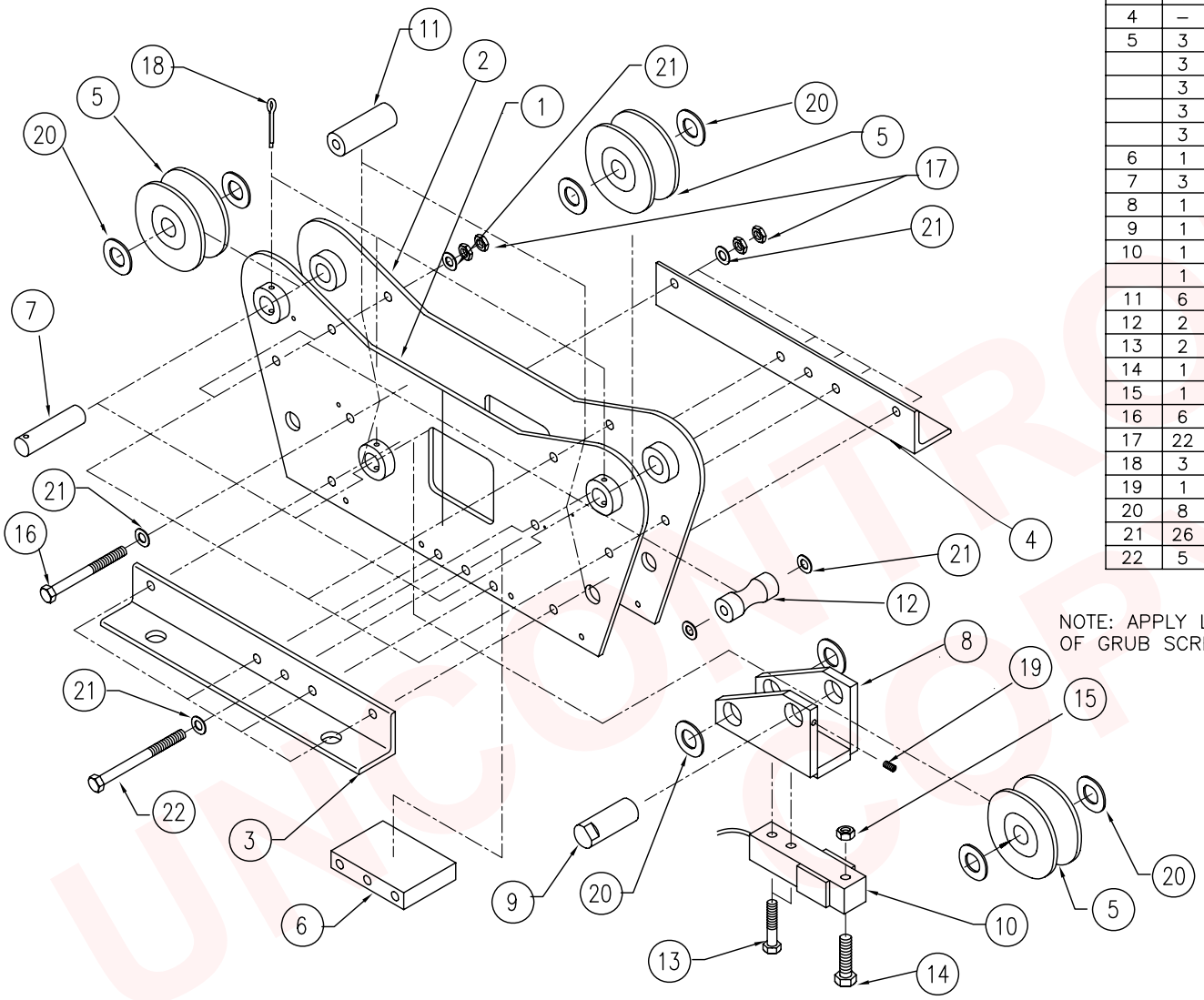
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 8352 6055
FAX +61 8 8352 1684

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



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

NOTE: APPLY LOCTITE 243 TO THREAD OF GRUB SCREW.

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

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	04/01/96	CORRECT PART NO 3 & 4 AS PER DR#124	M.O.
1.2	22/07/97	REFER TO DR#318	M.O.
1.3	20/07/98	REFER TO DR#494	M.O.
1.4	29/03/99	REFER TO DR#551	M.G.
1.5	27/01/05	REFER TO DR#345	G.C.
1.6	01/08/05	REFER TO DR#409	S.C.

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

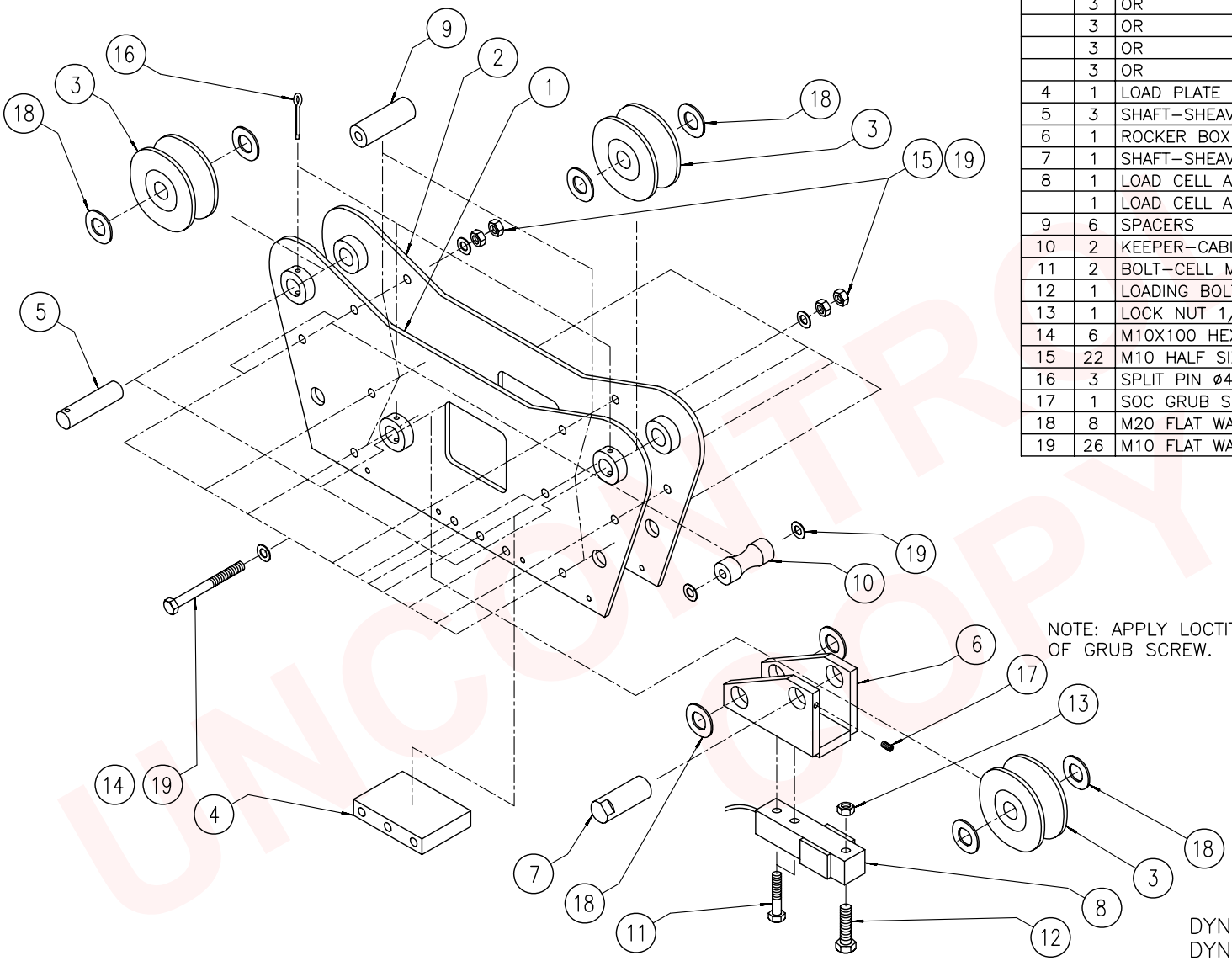
DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
F. LOCKER	M. OBST	–
15/09/95	15/09/95	

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: AS ABOVE
PROJECT: HRT–3 DYNO
TITLE: EXPLODED VIEW AND PARTS LIST FOR HRT–3 DYNO (VERTICAL MOUNT)
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 0104
FILE No: 010401AG.DWG
REV 1.6

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	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	–
4	1	LOAD PLATE	DWG0302	PLAHRT08	PLAHRT08SS
5	3	SHAFT–SHEAVE	DWG0225	SHAHRT12	–
6	1	ROCKER BOX	DWG0346	ROC3MAR	ROC3MARSS
7	1	SHAFT–SHEAVE–ROCKER BOX	DWG0289	SHAHRT11	–
8	1	LOAD CELL ASSY–5K–WITH PLUG	–	CELBTD5P	–
	1	LOAD CELL ASSY–5K–NO PLUG	–	CELBTD5	–
9	6	SPACERS	DWG0301	SPAHRT06	SPAHRT06SS
10	2	KEEPER–CABLE	DWG0300	KEEHRT02	KEEHRT02SS
11	2	BOLT–CELL MOUNTING 1/2"X1 3/4" SS	–	BOL1213HHSS	–
12	1	LOADING BOLT 1/2"X2" SS	DWG0287	SCR122CZP	–
13	1	LOCK NUT 1/2" UNF SS	–	NUT12HLSS	–
14	6	M10X100 HEX HEAD BOLT	–	BOLM10100HG	BOLM10100HSS
15	22	M10 HALF SIZE LOCK NUT	–	NUTM10HLG	NUTM10HSS
16	3	SPLIT PIN ø4X50 SS	–	PINCOTT03	–
17	1	SOC GRUB SCREW M6X12 CUP PT	–	SCRM612SG	–
18	8	M20 FLAT WASHER	–	WASM20FZP	WASM20FSS
19	26	M10 FLAT WASHER	–	WASM10FZP	WASM10FSS

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

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	11/01/96	CORRECT PART NO 14 AS PER DR#125	M.O.
1.2	22/07/97	REFER TO DR#318	M.O.
1.3	26/03/99	REFER TO DR#551	M.G.
1.4	27/01/05	REFER TO DR#345	G.C.
1.5	01/08/05	REFER TO DR#409	S.C.

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

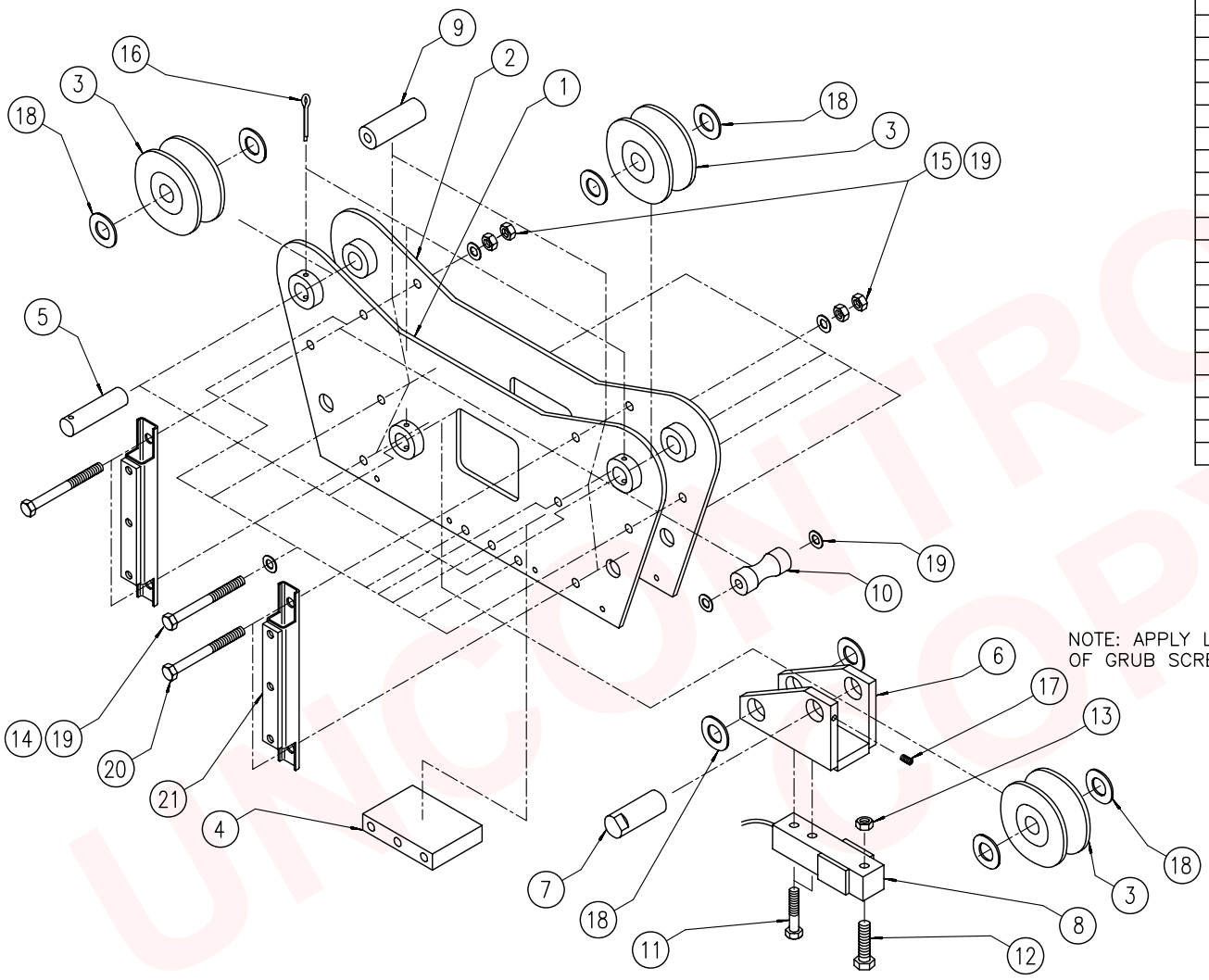
DO NOT SCALE DRAWING
ALL DIMENSIONS ARE IN MILLIMETERS
UNLESS OTHERWISE STATED

DRAWN	APPROVED	PART OF ASSY
F. LOCKER	M. OBST	–
15/09/95	15/09/95	

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: AS ABOVE
PROJECT: HRT–3 DYNO
TITLE: EXPLODED VIEW AND PARTS LIST FOR HRT–3 DYNO (HORIZONTAL MOUNT)
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 0786
FILE No: 078601AF.DWG
REV 1.5

3RD ANGLE



NOTE: APPLY LOCTITE 243 TO THREAD OF GRUB SCREW.

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	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	–
4	1	LOAD PLATE	DWG0302	PLAHRT08	PLAHRT08SS
5	3	SHAFT–SHEAVE	DWG0225	SHAHRT12	–
6	1	ROCKER BOX	DWG0346	ROC3MAR	ROC3MARSS
7	1	SHAFT–SHEAVE–ROCKER BOX	DWG0289	SHAHRT11	–
8	1	LOAD CELL ASSY–5K–WITH PLUG	–	CELBTD5P	–
	1	LOAD CELL ASSY–5K–NO PLUG	–	CELBTD5	–
9	6	SPACERS	DWG0301	SPAHRT06	SPAHRT06SS
10	2	KEEPER–CABLE	DWG0300	KEEHRT02	KEEHRT02SS
11	2	BOLT–CELL MOUNTING 1/2"X1 3/4" SS	–	BOL1213HHSS	–
12	1	LOADING BOLT 1/2"X2" SS	DWG0287	SCR122CZP	–
13	1	LOCK NUT 1/2" UNF SS	–	NUT12HLSS	–
14	7	M10X100 HEX HEAD BOLT	–	BOLM10100HG	BOLM10100HSS
15	22	M10 HALF SIZE LOCK NUT	–	NUTM10HLG	NUTM10HSS
16	3	SPLIT PIN ø4X50 SS	–	PINCOTT03	–
17	1	SOC GRUB SCREW M6X12 CUP PT	–	SCRM612SG	–
18	8	M20 FLAT WASHER	–	WASM20FZP	WASM20FSS
19	22	M10 FLAT WASHER	–	WASM10FZP	WASM10FSS
20	4	M10X120 HEX HEAD BOLT	–	BOLM10120HG	BOLM10120HSS
21	2	LANDING PAD	DWG0303	PADHRT01	–

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

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	11/01/96	CORRECT PART NO 14 AS PER DR#125	M.O.
1.2	30/10/97	REFER TO DR#318	M.O.
1.3	26/03/99	REFER TO DR#551	M.G.
1.4	27/01/05	REFER TO DR#345	G.C.
1.5	01/08/05	REFER TO DR#409	S.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	–
15/09/95	15/09/95	

ROBWAY SAFETY SYSTEMS PTY LTD
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SOUTH AUSTRALIA
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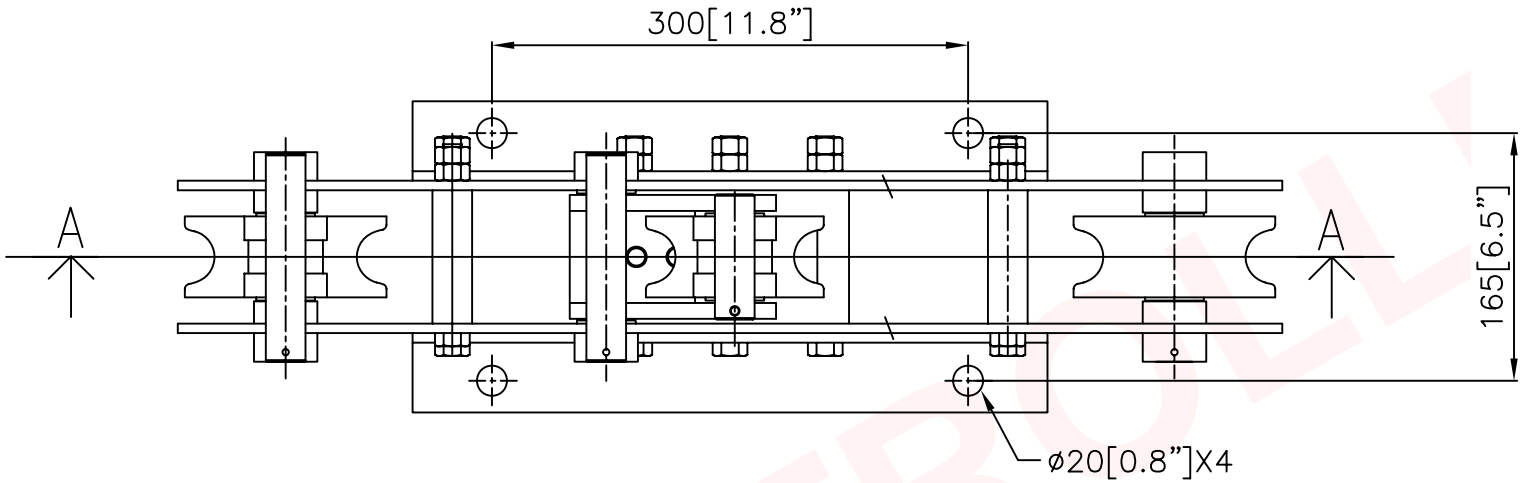
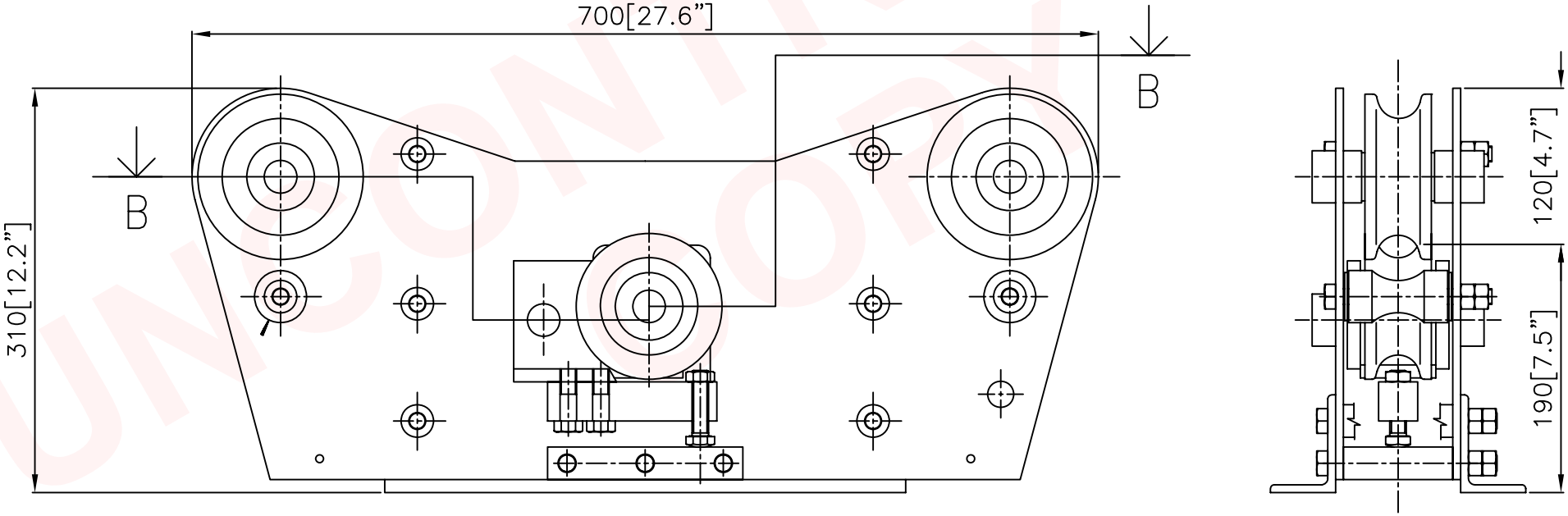
FAX +61 8 8352 1684

PART No: AS ABOVE
PROJECT: HRT–3 DYNO
TITLE: EXPLODED VIEW AND PARTS LIST FOR HRT–3 DYNO (HORIZONTAL MOUNT WITH LANDING PADS)
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 0787
FILE No: 078701AF.DWG
REV 1.5

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		

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

PART No: –

PROJECT: HRT–4 DYNO

TITLE: HRT–4 DYNAMOMETER DIMENSIONAL DETAIL

SCALE N/A

SHEET 1 OF 1

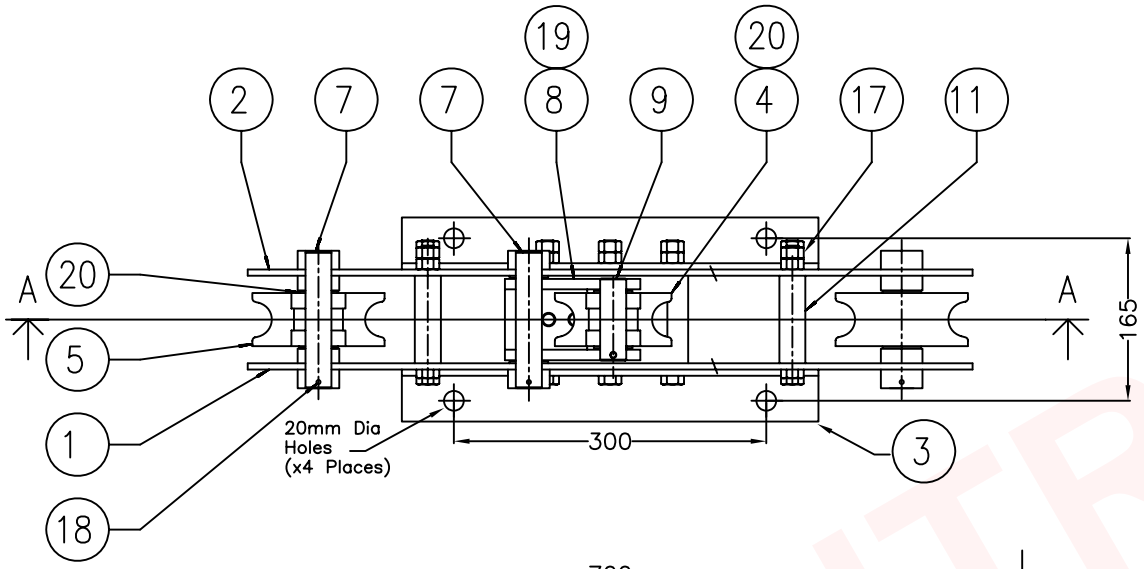
DRAWING No: DWG 1795

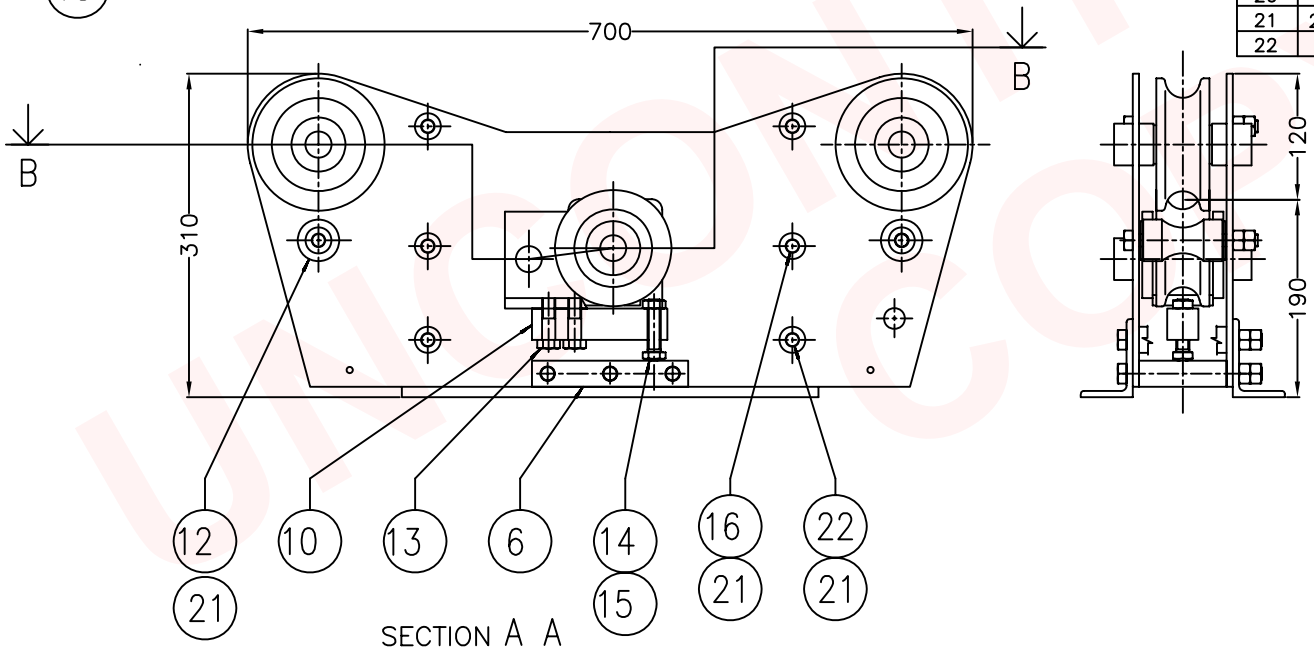
FILE No: 179501AA.DWG

REV 1.0

3RD ANGLE

SECTION B B





SECTION A A

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

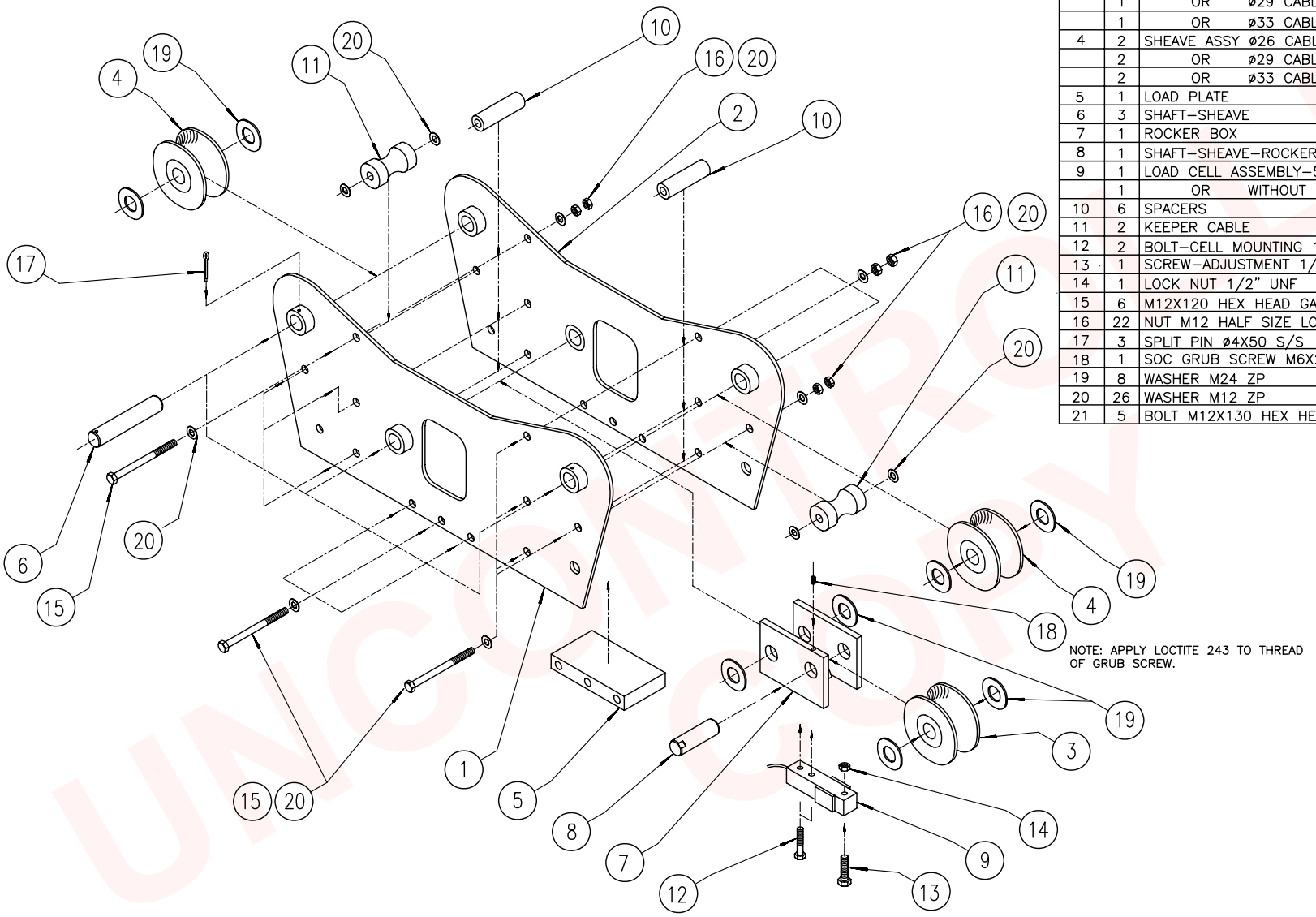
DRAWN	APPROVED
F. LOCKER	M. OBST
07/09/95	07/09/95

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



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	1	SHEAVE ASSY ø26 CABLE	DWG0348	SHE4C2526	–
	1	OR ø29 CABLE	DWG0348	SHE4C2529	–
	1	OR ø33 CABLE	DWG0348	SHE4C2533	–
4	2	SHEAVE ASSY ø26 CABLE	DWG0348	SHE4E2526	–
	2	OR ø29 CABLE	DWG0348	SHE4E2529	–
	2	OR ø33 CABLE	DWG0348	SHE4E2533	–
5	1	LOAD PLATE	DWG0350	PLAHRT4LD	PLAHRT4LDSS
6	3	SHAFT–SHEAVE	DWG0280	SHASH4	–
7	1	ROCKER BOX	DWG0349	ROCHRT4	ROCHRT4SS
8	1	SHAFT–SHEAVE–ROCKER BOX	DWG0347	SHARBSH4	–
9	1	LOAD CELL ASSEMBLY–5K–WITH PLUG	–	CELBTD5P	–
	1	OR WITHOUT PLUG	–	CELBTD5	–
10	6	SPACERS	DWG0352	SPAHRT4	SPAHRT4SS
11	2	KEEPER CABLE	DWG0351	KEEHRT4	KEEHRT4SS
12	2	BOLT–CELL MOUNTING 1/2"X1 3/4"	–	BOL1213HHSS	–
13	1	SCREW–ADJUSTMENT 1/2"X2"	–	SCR122CSS	–
14	1	LOCK NUT 1/2" UNF	–	NUT12HLSS	–
15	6	M12X120 HEX HEAD GALV	–	BOLM12120HG	BOLM12120SS
16	22	NUT M12 HALF SIZE LOCK NUT GALV	–	NUTM12HLG	NUTM12HSS
17	3	SPLIT PIN ø4X50 S/S	–	PINCOTT03	–
18	1	SOC GRUB SCREW M6X20 CUP PT S/S	–	SCRM620SG	–
19	8	WASHER M24 ZP	–	WASM24FZP	WASM24FSS
20	26	WASHER M12 ZP	–	WASM12FZP	WASM12FSS
21	5	BOLT M12X130 HEX HEAD GALV	–	BOLM12130HG	BOLM12130HSS

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
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	02/10/98	REFER TO DR#494	M.O.
1.5	26/03/99	REFER TO DR#551	D.P.
1.6	27/01/05	REFER TO DR#345	G.C.
1.7	01/08/05	REFER TO DR#409	S.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	–
07/09/95	07/09/95	

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

PART No: –

PROJECT: HRT–4 DYNO

TITLE: EXPLODED VIEW AND PARTS LIST FOR HRT–4 DYNO (EXCLUDING MOUNTING ANGLE BRACKET)

SCALE N/A

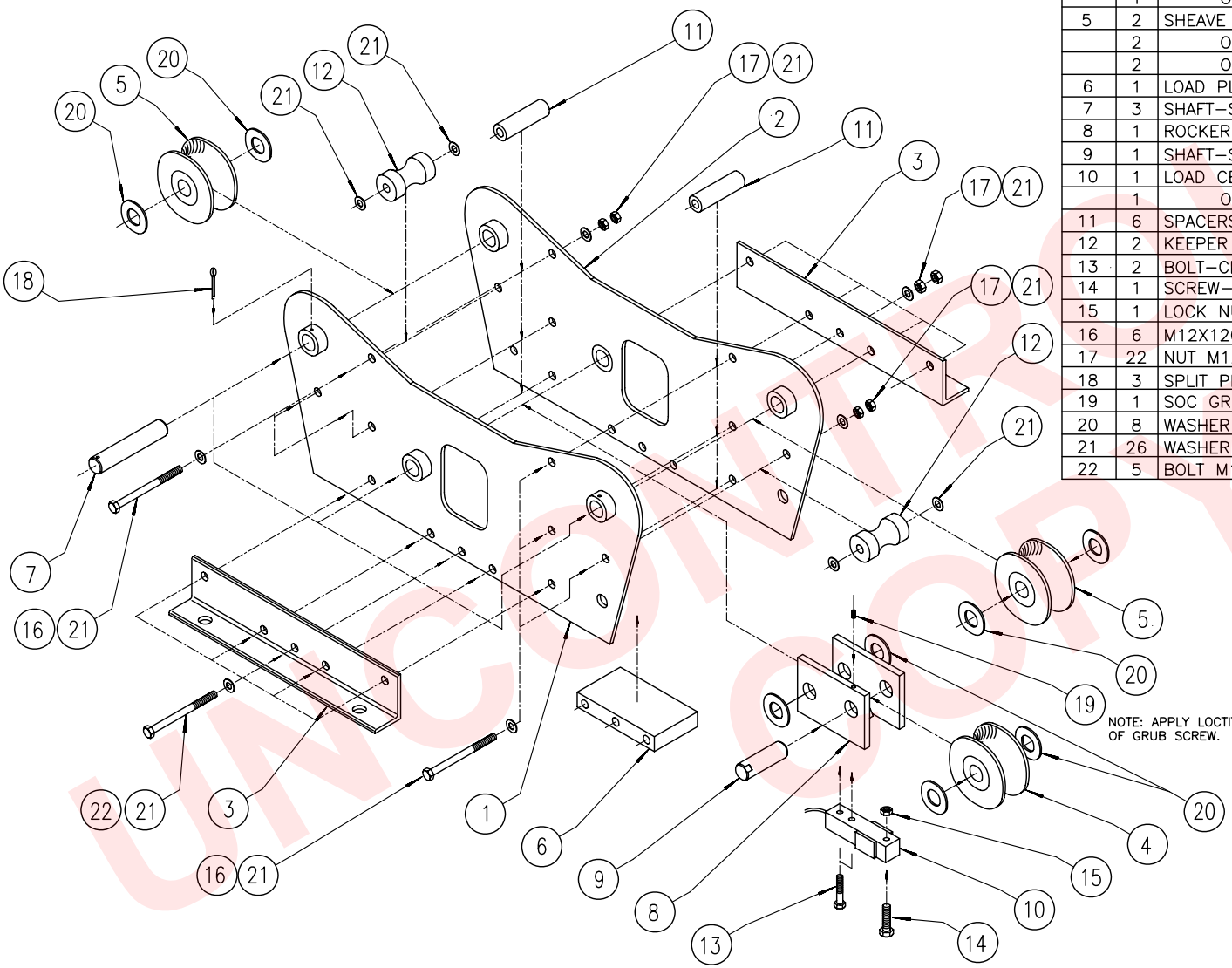
SHEET 1 OF 1

DRAWING No: DWG 0799

FILE No: 079901AH.DWG

REV 1.7

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	SHEH4C2526	–
	1	OR ø29 CABLE	DWG0348	SHEH4C2529	–
	1	OR ø33 CABLE	DWG0348	SHEH4C2533	–
5	2	SHEAVE ASSY ø26 CABLE	DWG0348	SHEH4E2526	–
	2	OR ø29 CABLE	DWG0348	SHEH4E2529	–
	2	OR ø33 CABLE	DWG0348	SHEH4E2533	–
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 M6X20 CUP PT S/S	–	SCRM620SG	–
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	29/03/99	REFER TO DR#551	D.P.
1.2	27/01/05	REFER TO DR#345	G.C.
1.3	01/08/05	REFER TO DR#409	S.C.
1.4	01/08/07	REFER TO PCR#24	S.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	03/11/97

PART OF ASSY: –

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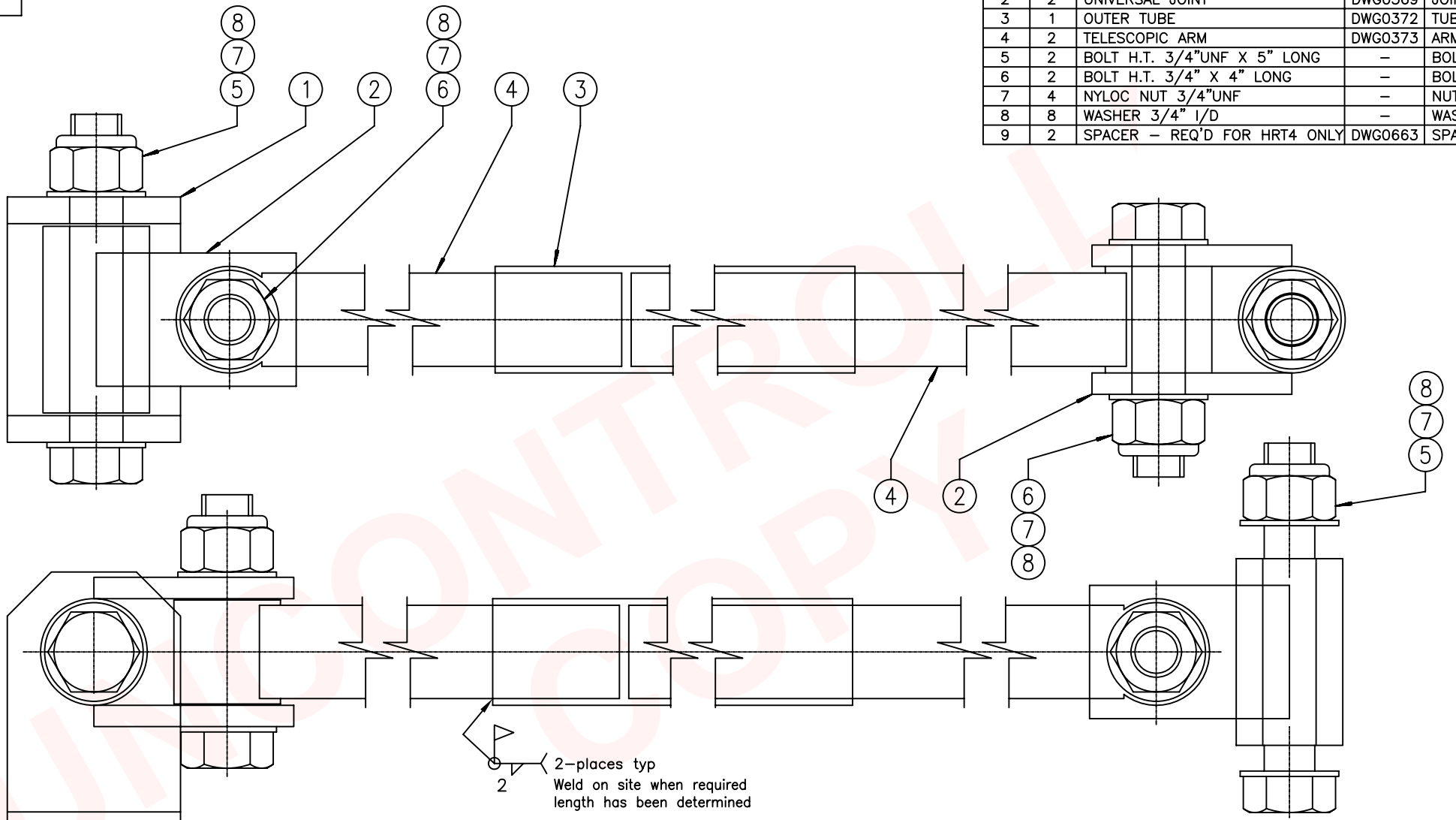
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 352 6055
FAX +61 8 352 1684

PART No: SEE ABOVE
PROJECT: HRT–4 DYNO
TITLE: EXPLODED VIEW AND PARTS LIST FOR HRT–4 DYNO (VERTICAL MOUNT)
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 0340
FILE No: 034001AE.DWG
REV 1.4

3RD ANGLE

ITEM	QTY	MATERIAL/DESCRIPTION	DWG No.	STOCK CODE
1	1	MOUNTING BRACKET	DWG0368	BRAMAA0368
2	2	UNIVERSAL JOINT	DWG0369	JOINU0369
3	1	OUTER TUBE	DWG0372	TUB00372
4	2	TELESCOPIC ARM	DWG0373	ARMTAA0373
5	2	BOLT H.T. 3/4"UNF X 5" LONG	–	BOL34U5ZP
6	2	BOLT H.T. 3/4" X 4" LONG	–	BOL34U4ZP
7	4	NYLOC NUT 3/4"UNF	–	NUTNYU34ZP
8	8	WASHER 3/4" I/D	–	WAS34FZP
9	2	SPACER – REQ'D FOR HRT4 ONLY	DWG0663	SPAAA0663



IMPORTANT :–
When altering this drawing ensure that the changes are also included on drawing DWG0371

FINISH – PRIMER – POLYZINC 660
COATING – INTERPRON 610 MATT BLACK

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.0	16/10/01	CONVERTED TO AUTOCAD FORMAT	S.C.
1.1	25/08/03	REFER TO DR#186	S.C.

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

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

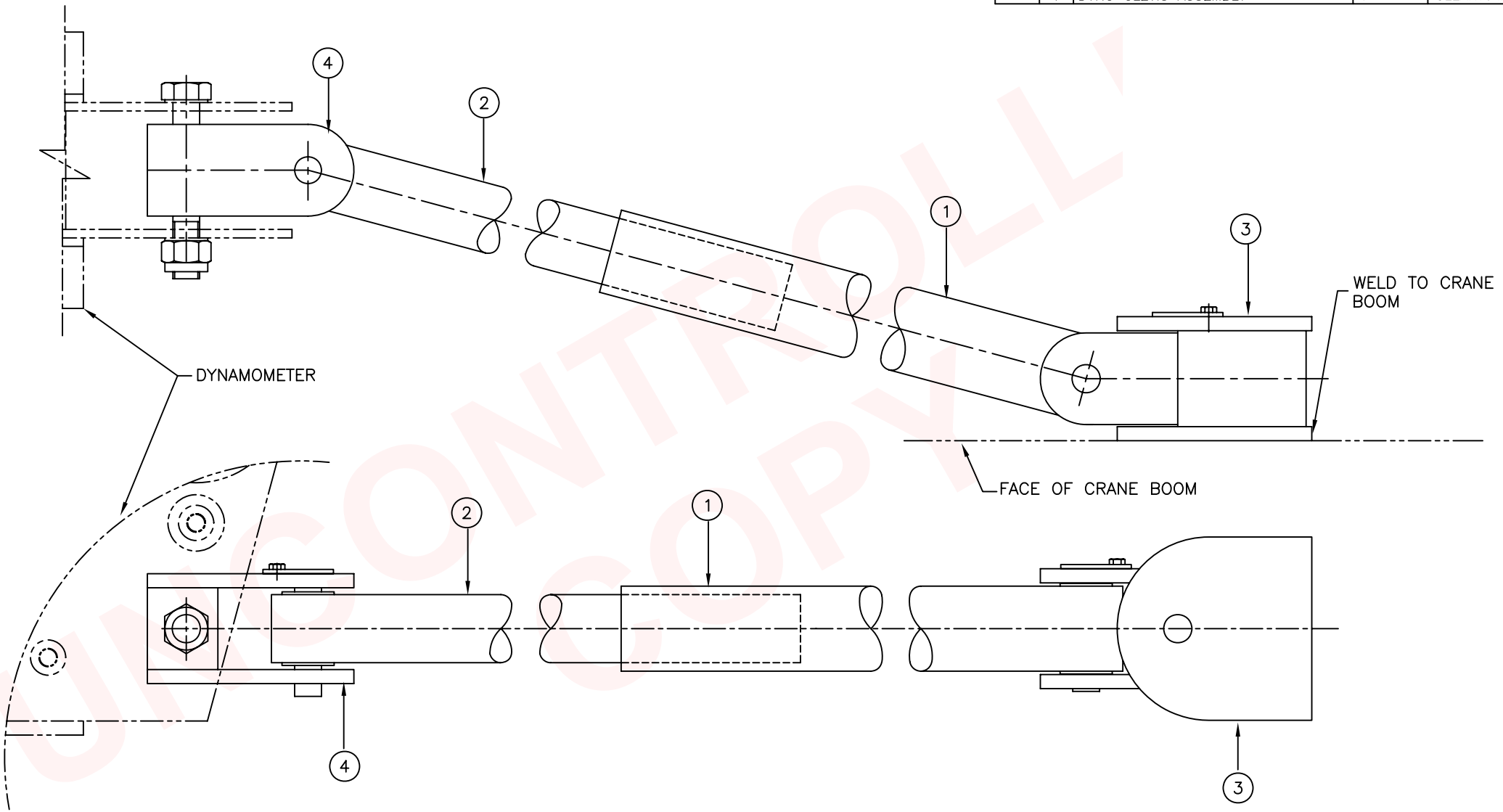
DRAWN	APPROVED	PART OF ASSY
F. LOCKER	M. OBST	–
10/11/94	10/11/94	

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: ARMART0370
PROJECT: ARTICULATED ARM
TITLE: GENERAL ARRANGEMENT
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 0370
FILE No: 037001AB.DWG
REV 1.1

3RD ANGLE

ITEM	QTY	MATERIAL/DESCRIPTION	DWG No.	STOCK CODE
1	1	OUTSIDE TUBE	DWG0807	TUBART04
2	1	INSIDE TUBE	DWG0808	TUBART03
3	1	BOOM CLEVIS ASSEMBLY	DWG1878	CLEART03
4	1	DYNO CLEVIS ASSEMBLY	DWG1879	CLEART04A



REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.0	19/09/95	ISSUED FOR MANUFACTURE	
1.1	23/02/99	REFER TO DR#541	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
F. LOCKER	M. OBST	—
19/09/95	19/09/95	

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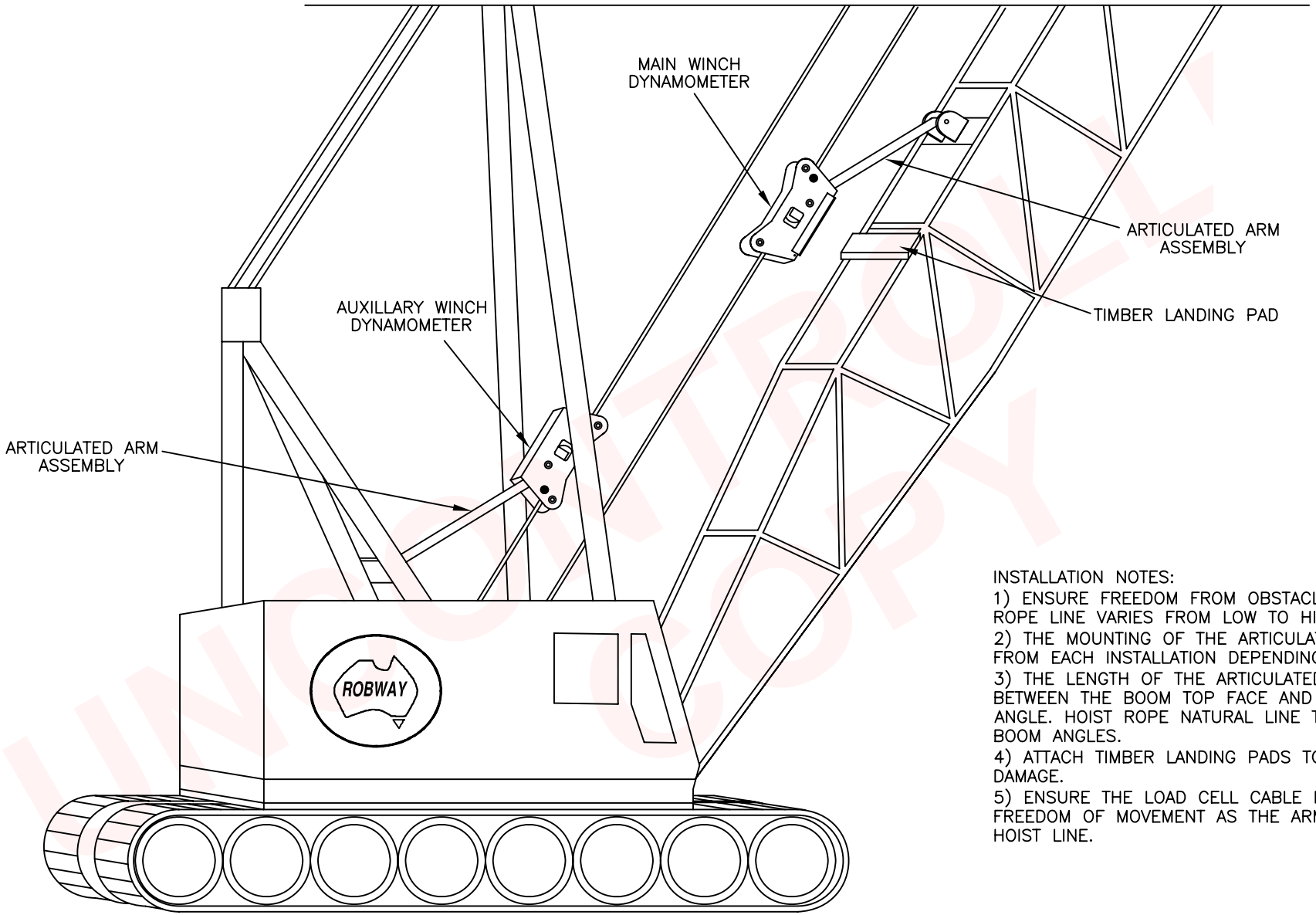
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 8352 6055
FAX +61 8 8352 1684

PART No: ARMARTIC02
PROJECT: ARTIC ARM – H/D
TITLE: GENERAL ARRANGEMENT
SCALE N/A
SHEET 1 OF 1
DRAWING No: DWG 0805
FILE No: 080501AB.DWG
REV 1.1

ARTICULATED ARM MOUNTED DYNAMOMETERS AT BOOM BUTT



INSTALLATION NOTES:

1) ENSURE FREEDOM FROM OBSTACLES THROUGH OUT ARC AS ROPE LINE VARIES FROM LOW TO HIGH BOOM ANGLE.

2) THE MOUNTING OF THE ARTICULATED ARM ASSEMBLY CAN VARY FROM EACH INSTALLATION DEPENDING ON THE BOOM CONSTRUCTION.

3) THE LENGTH OF THE ARTICULATED ARM MUST SUIT THE DISTANCE BETWEEN THE BOOM TOP FACE AND THE ROPE WHEN AT MAXIMUM ANGLE. HOIST ROPE NATURAL LINE TO BE MAINTAINED FOR ALL BOOM ANGLES.

4) ATTACH TIMBER LANDING PADS TO THE BOOM TO PROTECT FROM DAMAGE.

5) ENSURE THE LOAD CELL CABLE IS FITTED SAFELY SECURED WITH FREEDOM OF MOVEMENT AS THE ARM ASSEMBLY FOLLOWS THE HOIST LINE.

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	—
13/07/01	13/07/01	

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

PART No: —

PROJECT: —

TITLE: TYPICAL DYNAMOMETER INSTALLATION TO SUIT STRUT BOOM CRANES

SCALE N/A

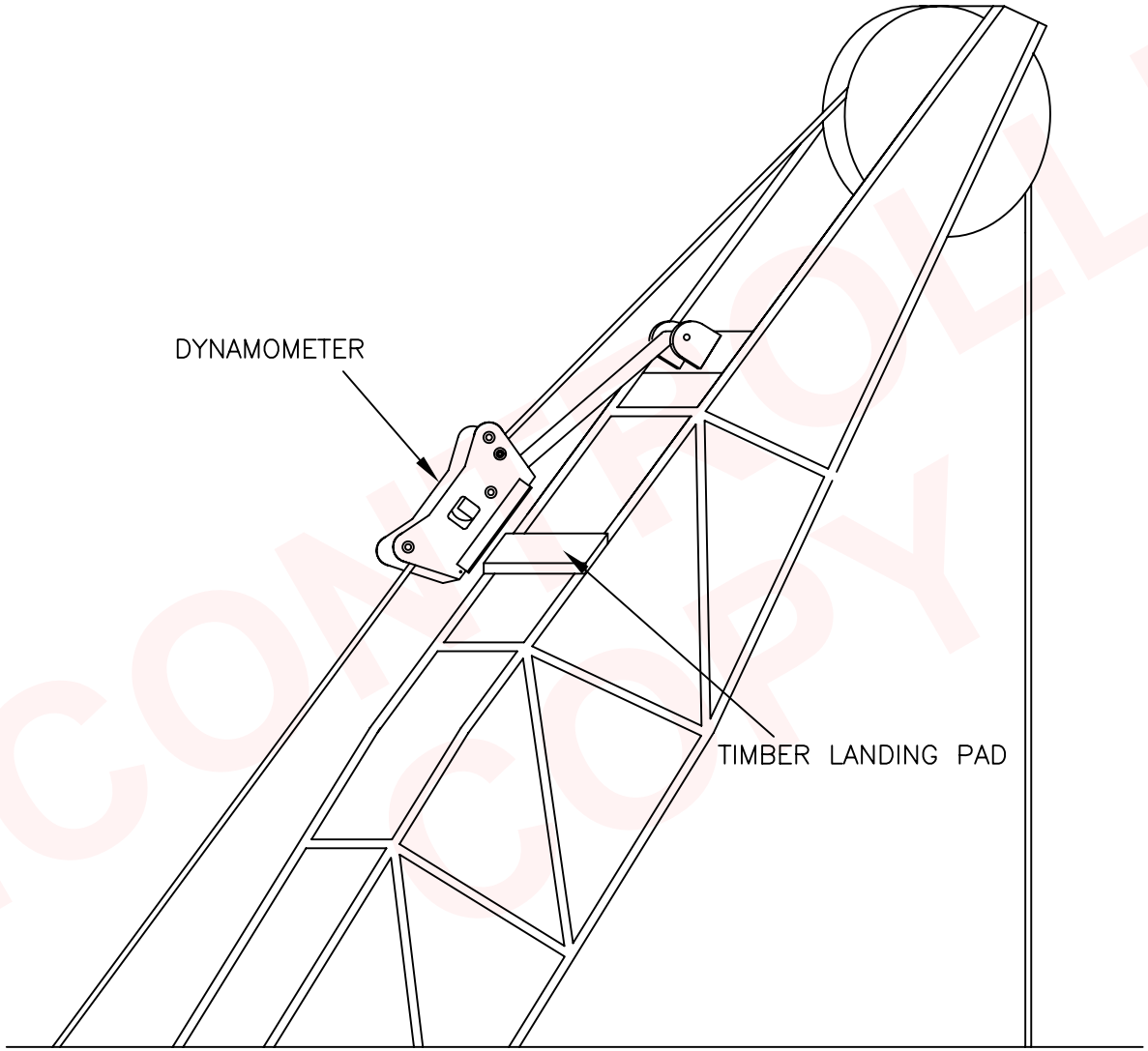
SHEET 1 OF 4

DRAWING No: DWG 2468

FILE No: 246801AA.DWG

REV 1.0

ARTICULATED ARM MOUNTED DYNAMOMETERS AT BOOM TIP



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	—
13/07/01	13/07/01	

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: —

TITLE: TYPICAL DYNAMOMETER INSTALLATION TO SUIT STRUT BOOM CRANES

SCALE N/A

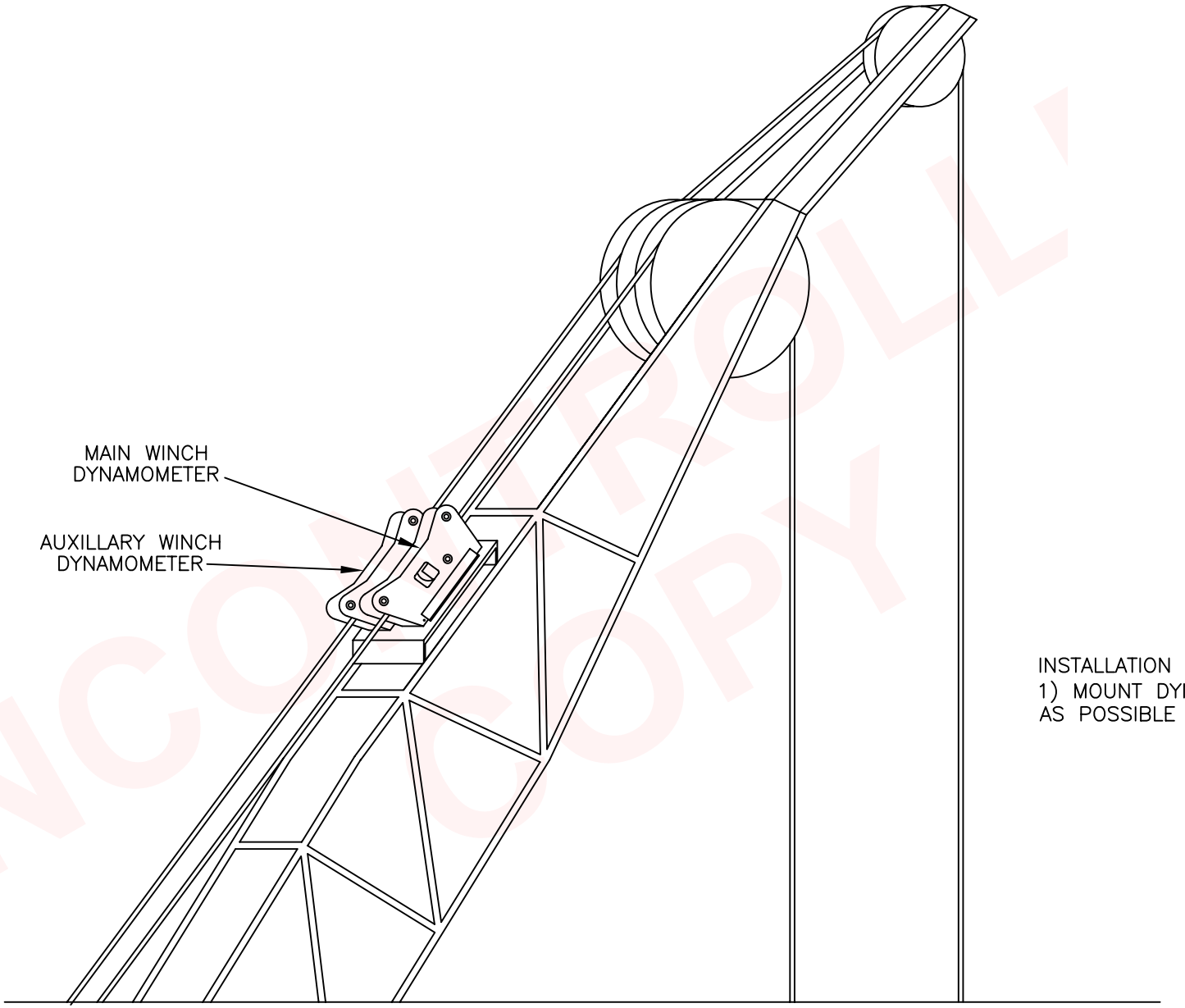
SHEET 2 OF 4

DRAWING No: DWG 2468

FILE No: 246801AA.DWG

REV 1.0

FIXED MOUNTED DYNAMOMETERS AT BOOM TIP



INSTALLATION NOTES:

1) MOUNT DYNAMOMETERS AS CLOSE AS POSSIBLE TO THE BOOM TIP.

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	—
13/07/01	13/07/01	

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

PART No: —

PROJECT: —

TITLE: TYPICAL DYNAMOMETER INSTALLATION TO SUIT STRUT BOOM CRANES

SCALE N/A

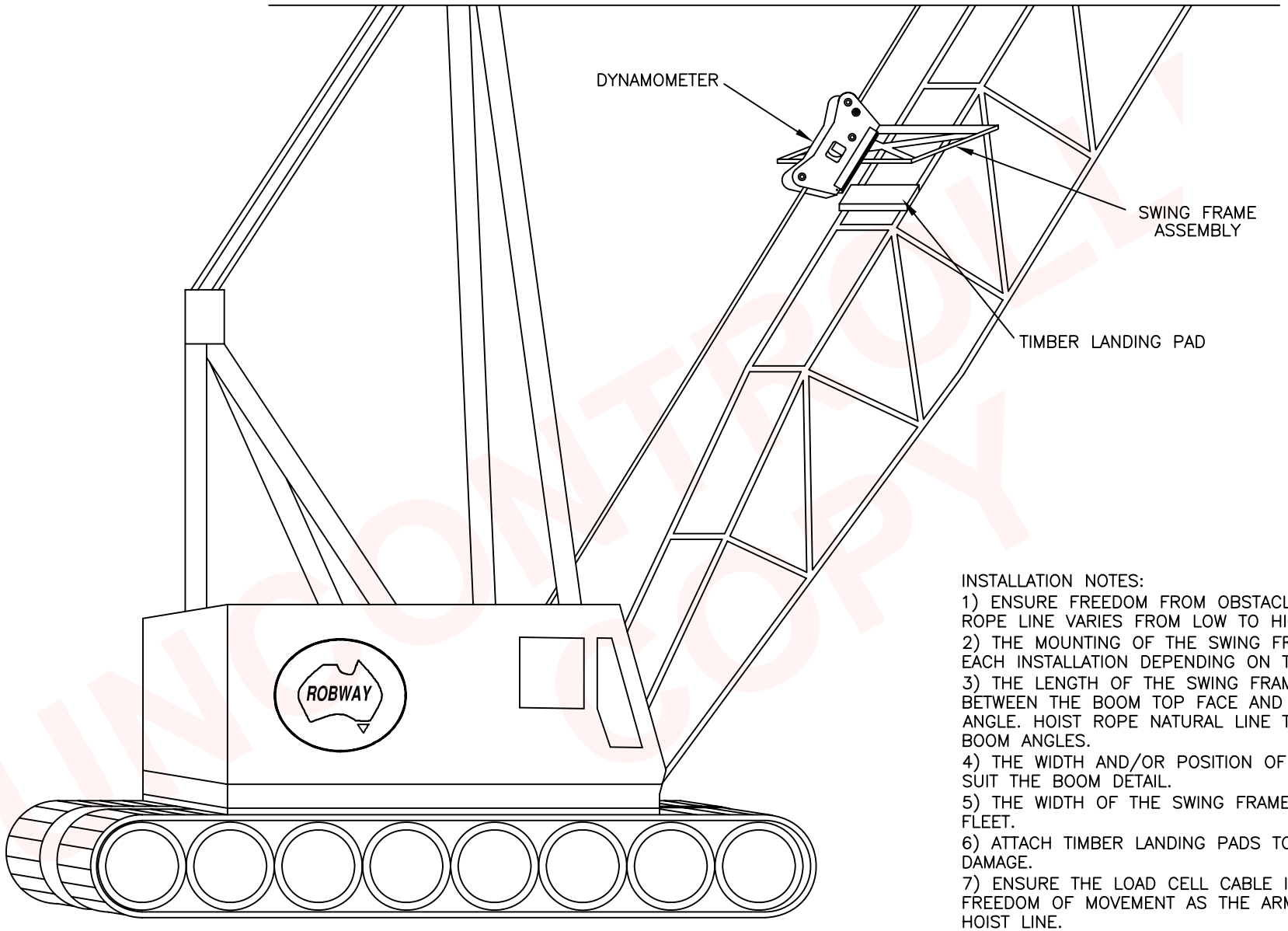
SHEET 3 OF 4

DRAWING No: DWG 2468

FILE No: 246801AA.DWG

REV 1.0

SWING FRAME MOUNTED DYNAMOMETERS AT BOOM BUTT



INSTALLATION NOTES:

1) ENSURE FREEDOM FROM OBSTACLES THROUGH OUT ARC AS ROPE LINE VARIES FROM LOW TO HIGH BOOM ANGLE.
2) THE MOUNTING OF THE SWING FRAME ASSEMBLY CAN VARY FROM EACH INSTALLATION DEPENDING ON THE BOOM CONSTRUCTION.
3) THE LENGTH OF THE SWING FRAME MUST SUIT THE DISTANCE BETWEEN THE BOOM TOP FACE AND THE ROPE WHEN AT MAXIMUM ANGLE. HOIST ROPE NATURAL LINE TO BE MAINTAINED FOR ALL BOOM ANGLES.
4) THE WIDTH AND/OR POSITION OF THE SWING FRAME BASE MUST SUIT THE BOOM DETAIL.
5) THE WIDTH OF THE SWING FRAME TO SUIT THE HOIST DRUM FLEET.
6) ATTACH TIMBER LANDING PADS TO THE BOOM TO PROTECT FROM DAMAGE.
7) ENSURE THE LOAD CELL CABLE IS FITTED SAFELY SECURED WITH FREEDOM OF MOVEMENT AS THE ARM ASSEMBLY FOLLOWS THE HOIST LINE.

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	–
13/07/01	13/07/01	

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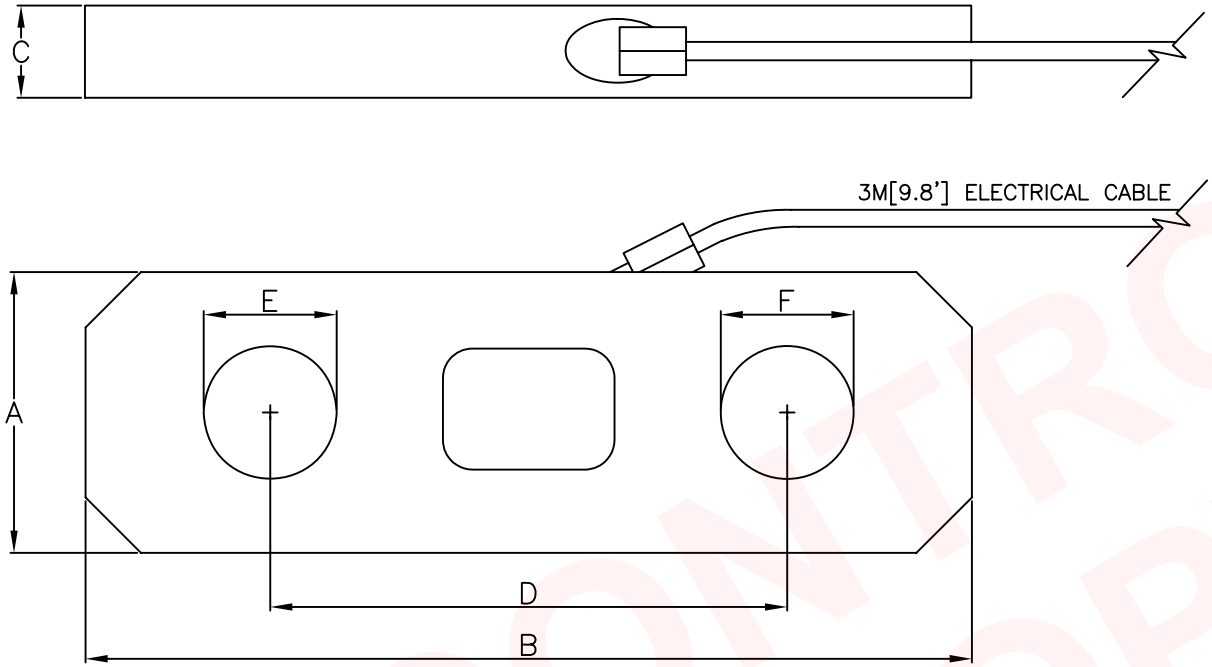
SOUTH AUSTRALIA
PHONE +61 8 8352 6055
FAX +61 8 8352 1684

PART No: –
PROJECT: –
TITLE: TYPICAL DYNAMOMETER INSTALLATION TO SUIT STRUT BOOM CRANES
SCALE N/A
SHEET 4 OF 4
DRAWING No: DWG 2468
FILE No: 246801AA.DWG
REV 1.0

3RD ANGLE

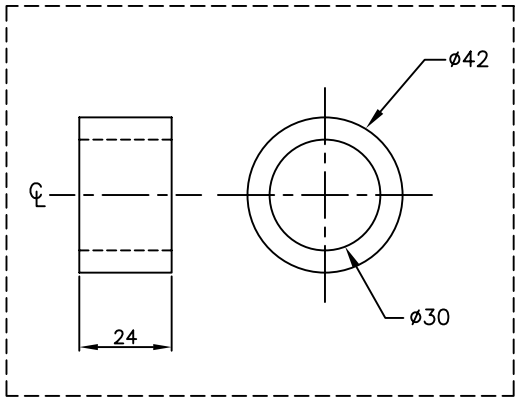


GENERAL SPECIFICATIONS

LINEARITY:	0.15% NOMINAL
REPEATABILITY ERROR:	<0.10%
HYSTERESIS:	<0.10%
CREEP:	<0.10%
OUTPUT:	2MV/V NOMINAL
EXCITATION:	15VDC. REC MAX.
ISOLATION	>2000 MEGOHMS AT 50VDC
OVERLOAD	
NO ELECTRICAL DAMAGE	150%
ULTIMATE	>400%
TEMPERATURE EFFECTS	
ON ZERO	<0.005% /DEG C
ON SPAN	<0.005% /DEG C
COMPENSATION RANGE:	−10 TO +70 DEG C
SEALING:	IP68 FULLY ENCAPSULATED

LOAD CELL TYPE	A		B		C		D		E		F	
	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES	MM	INCHES
6MT	48	1.9	155	6.1	25	1.0	100	3.9	31	1.2	31	1.2
10MT	78	3.1	260	10.2	25	1.0	158	6.2	42	1.7	42	1.7
15MT	78	3.1	260	10.2	25	1.0	158	6.2	42	1.7	42	1.7
20MT	78	3.1	260	10.2	25	1.0	158	6.2	42	1.7	42	1.7
30MT	102	4.0	300	11.8	38	1.5	168	6.6	42	1.7	42	1.7
56MT	146	5.7	457	18.0	37	1.4	316	12.4	76	3.0	76	3.0
91MT	174	6.9	560	22.0	73	2.9	390	15.4	79	3.1	79	3.1

SPACERS APPLICABLE TO
10/15/20T TENSION CELLS



REV	DATE	DESCRIPTION OF CHANGE	
1.1	06/05/98	REFER TO DR#480	M.O.
1.2	05/11/98	REFER TO DR#564	M.O.
1.3	05/01/06	ADD 20T TENSION CELL & SPACER DETAIL	S.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
M. TURNER	M. OBST	—
08/03/96	15/01/97	

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

PART No: —

PROJECT: —

TITLE: TENSION PLATE CELL DIMENSIONS FOR 6, 10, 15, 20, 30, 56, 91MT CELLS

SCALE N/A

SHEET 1 OF 1

DRAWING No: DWG 0990

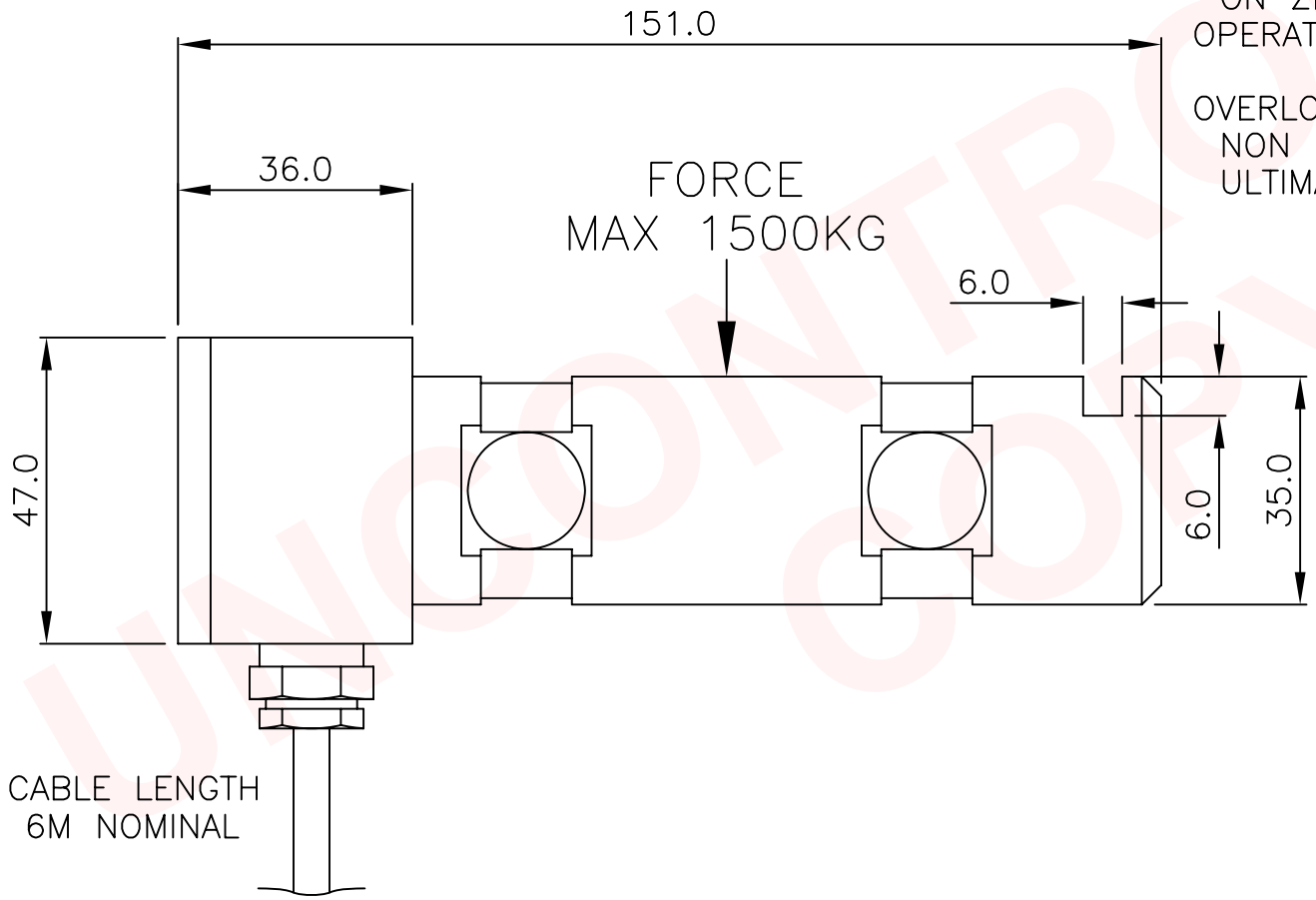
FILE No: 099001AD.DWG

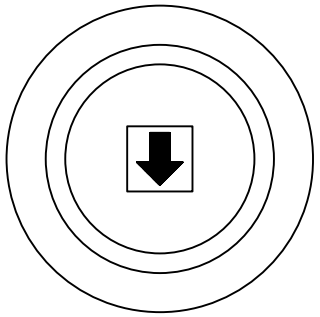
REV 1.3

3RD ANGLE

GENERAL SPECIFICATIONS

CAPACITY:	1500KG
EXCITATION:	12VAC/DC
RATED OUTPUT:	TYPICAL, 1mV/V
NON LINEARITY:	<1%
REPEATABILITY ERROR:	<0.1%
TEMPERATURE EFFECTS	
ON OUTPUT	<0.005%/DEG C
ON ZERO SHIFT	<0.005%/DEG C
OPERATION RANGE	MATERIAL DEPENDANT −10 TO +70 DEG C
OVERLOAD EFFECTS	
NON ELECTRICAL DAMAGE	<200%
ULTIMATE	>400%





DIRECTION OF
CENTRE FORCE

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	11/05/05	REFER TO DR#369	S.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
C. HOBBY	D. PLANTHABER	—
10/05/99	10/05/99	

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: CELRW1500

TITLE: RW1500 LOAD PIN DIMENSIONAL DETAIL

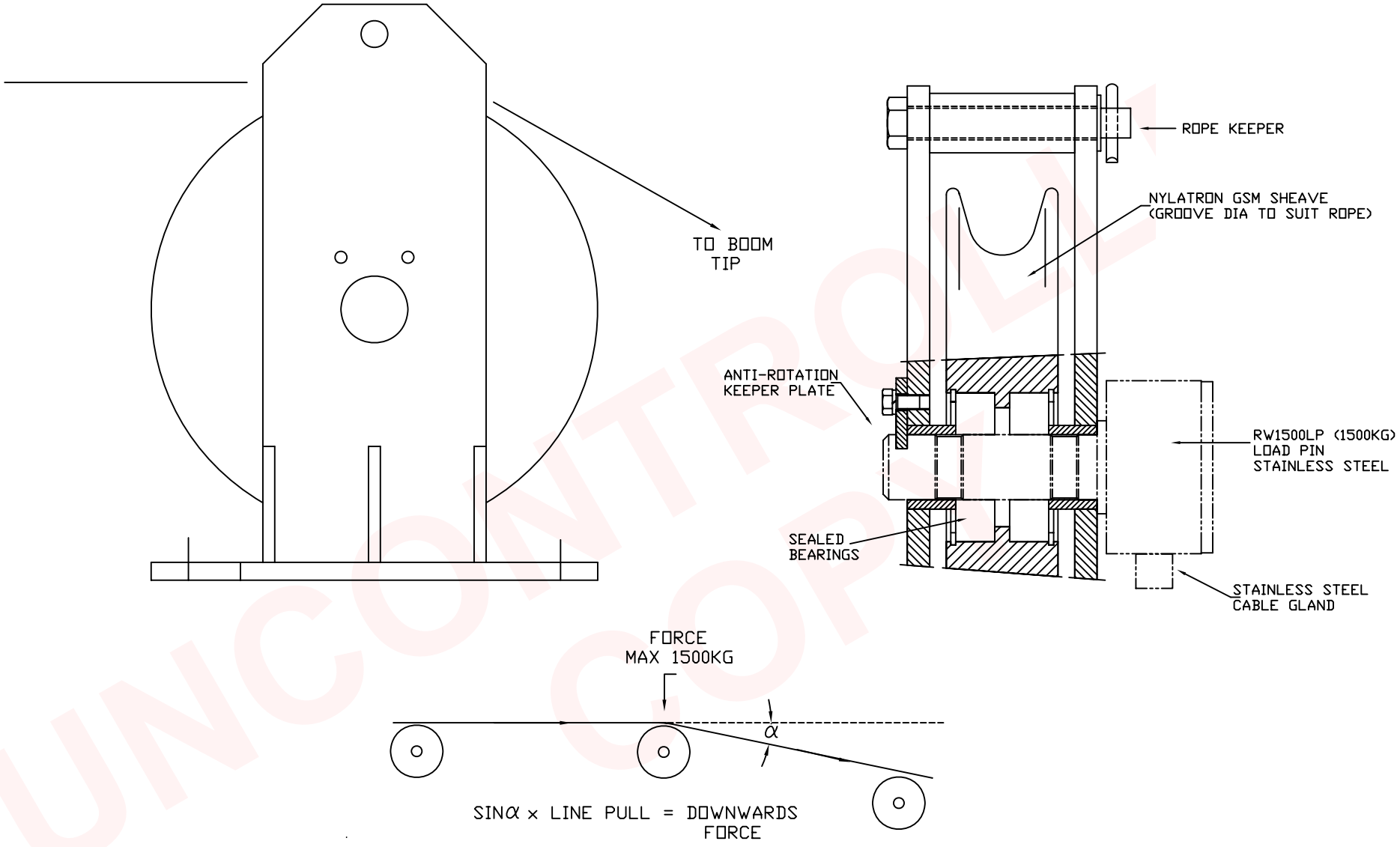
SCALE N/A

SHEET 1 OF 1

DRAWING No: DWG 1938

FILE No: 193801AB.DWG

REV 1.1



REV	DATE	DESCRIPTION OF CHANGE	APPR'D

	SIGN	DATE
DRAWN	M. TURNER	8-3-96
SIGN		

ROBWAY SAFETY SYSTEMS PTY LTD

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

PART No:

PROJECT:

TITLE:
SINGLE SHEAVE TENSIOMETER

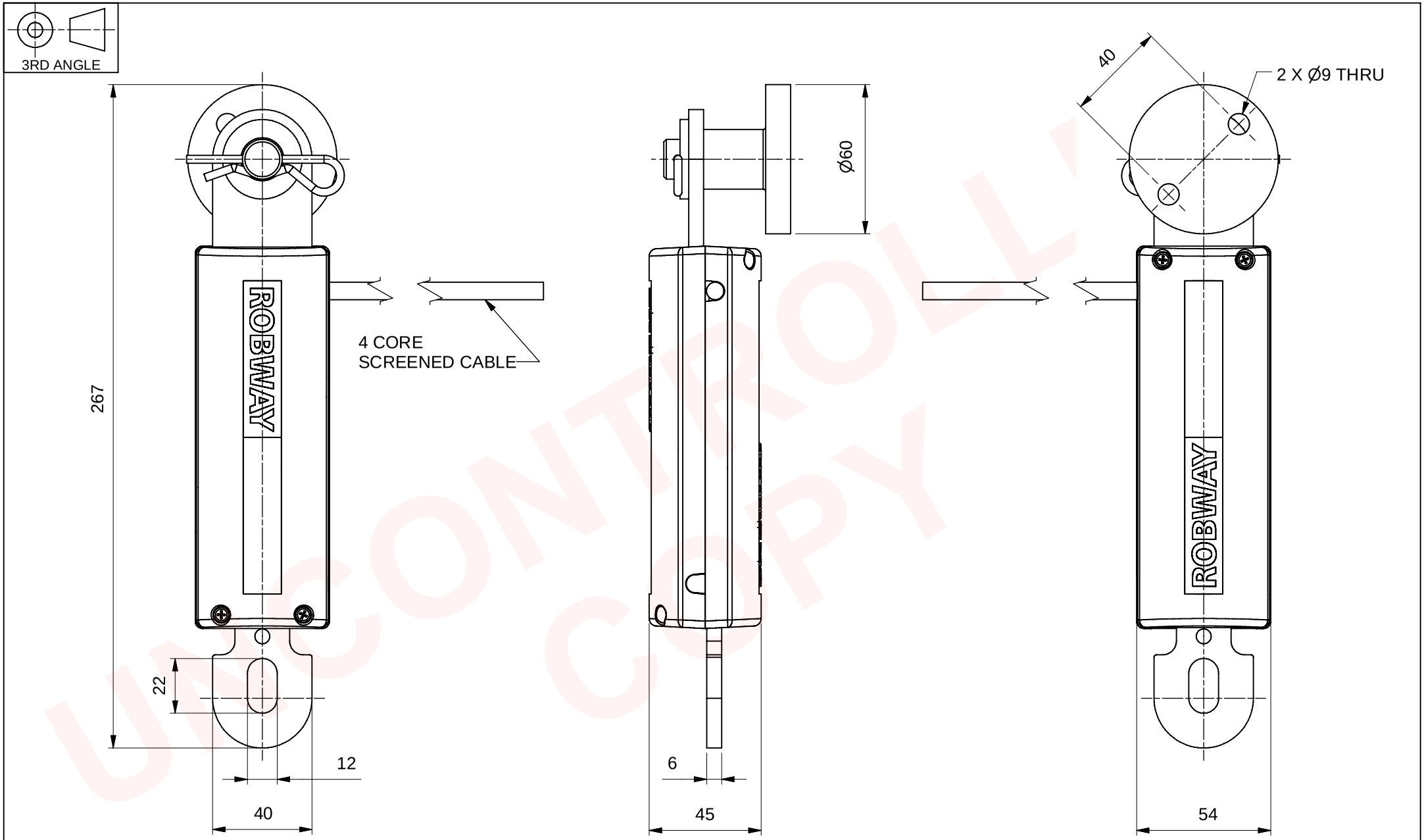
SCALE N/A

SHEET 1 OF 1

DRAWING No: DWG 0991

FILE No: 099101A.DWG

REV A



REV	DATE	DESCRIPTION OF CHANGE	APPRV'D

TOL: X. +/-1
X.X +/-0.2
X.XX +/-0.02

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

DRAWN BY	APPROVED BY	PART OF ASSY
S. CHAMBERS	A. CANLAS	-
19/04/2005	19/04/2005	

ROBWAY
Crane Load Instrumentation
web : www.robway.com.au
32 West Thebarton Rd
THEBARTON
SOUTH AUSTRALIA 5031
PHONE: +61 8 8238 3500
FAX: +61 8 8352 1684

PART No:	PROJECT:
SWISBB5	BB5 ATB SWITCH

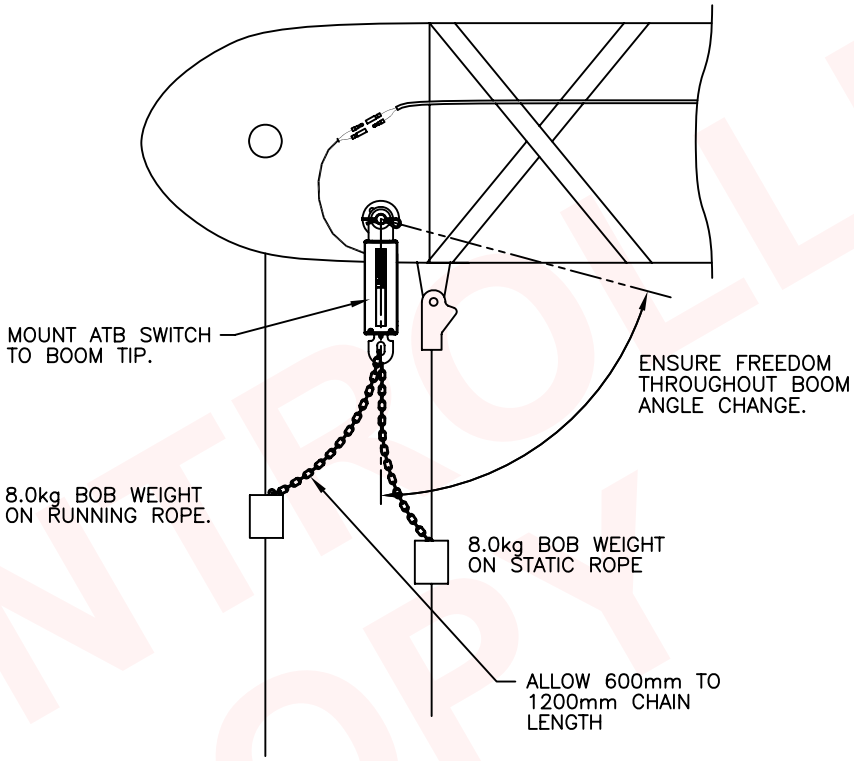
TITLE: DIMENSIONAL DETAIL

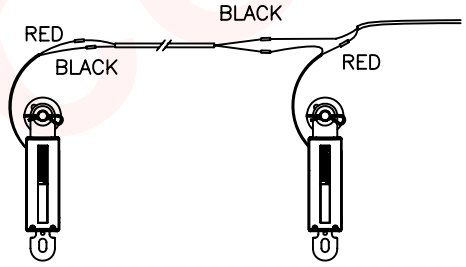
SCALE: N/A

SHEET: 1 OF 1

DRAWING No:	FILE No:	REV
DWG 2934	293401AA.idw	1.0

STRUT BOOM SINGLE CORE PAYOUT CABLE APPLICATION





ATB SWITCH CONNECTION FOR MAIN
AND FLY

REV	DATE	DESCRIPTION OF CHANGE	APPR'D
1.1	03/08/05	REFER TO DR#421	A.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
S. CHAMBERS	A. CANLAS	—
10/07/01	10/07/01	

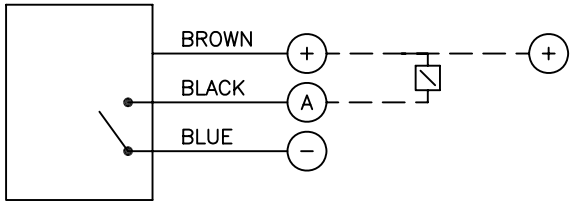
ROBWAY SAFETY SYSTEMS PTY LTD
32 WEST THEBARTON RD
THEBARTON 5031
SOUTH AUSTRALIA
PHONE +61 8 8352 6055
FAX +61 8 8352 1684

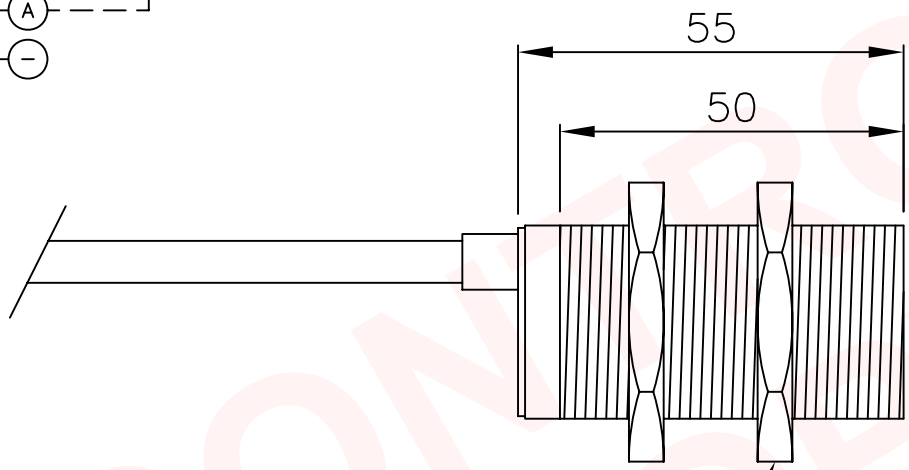
PART No: —
PROJECT: —
TITLE: ATB SWITCH INSTALLATION DETAILS
SCALE N/A
SHEET 3 OF 3
DRAWING No: DWG 0667
FILE No: 066701AB.DWG
REV 1.1

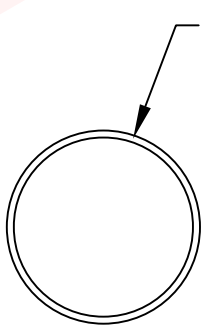
3RD ANGLE

WIRING DETAIL

(NPN – NORMALLY OPEN)







2 X LOCKNUTS SUPPLIED WITH PROX. SWITCH.

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	–
10/07/01	10/07/01	

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: SWIPROX02

PROJECT: PROXIMITY SWITCH

TITLE: DIMENSIONAL DETAILS

SCALE N/A

SHEET 1 OF 1

DRAWING No: DWG 2461

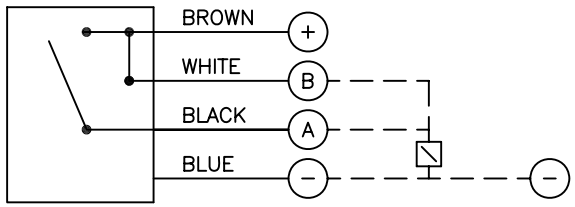
FILE No: 246101AA.DWG

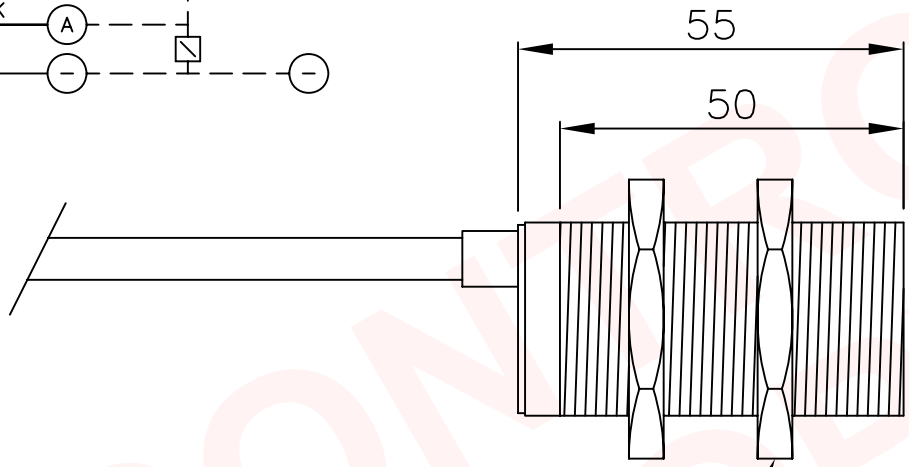
REV 1.0

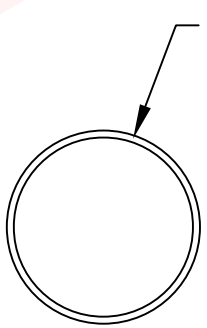
3RD ANGLE

WIRING DETAIL

(PNP – NORMALLY OPEN / NORMALLY CLOSED)







2 X LOCKNUTS SUPPLIED WITH PROX. SWITCH.

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		–
10/07/01		

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: SWIPROX03

PROJECT: PROXIMITY SWITCH

TITLE: DIMENSIONAL DETAILS

SCALE N/A

SHEET 1 OF 1

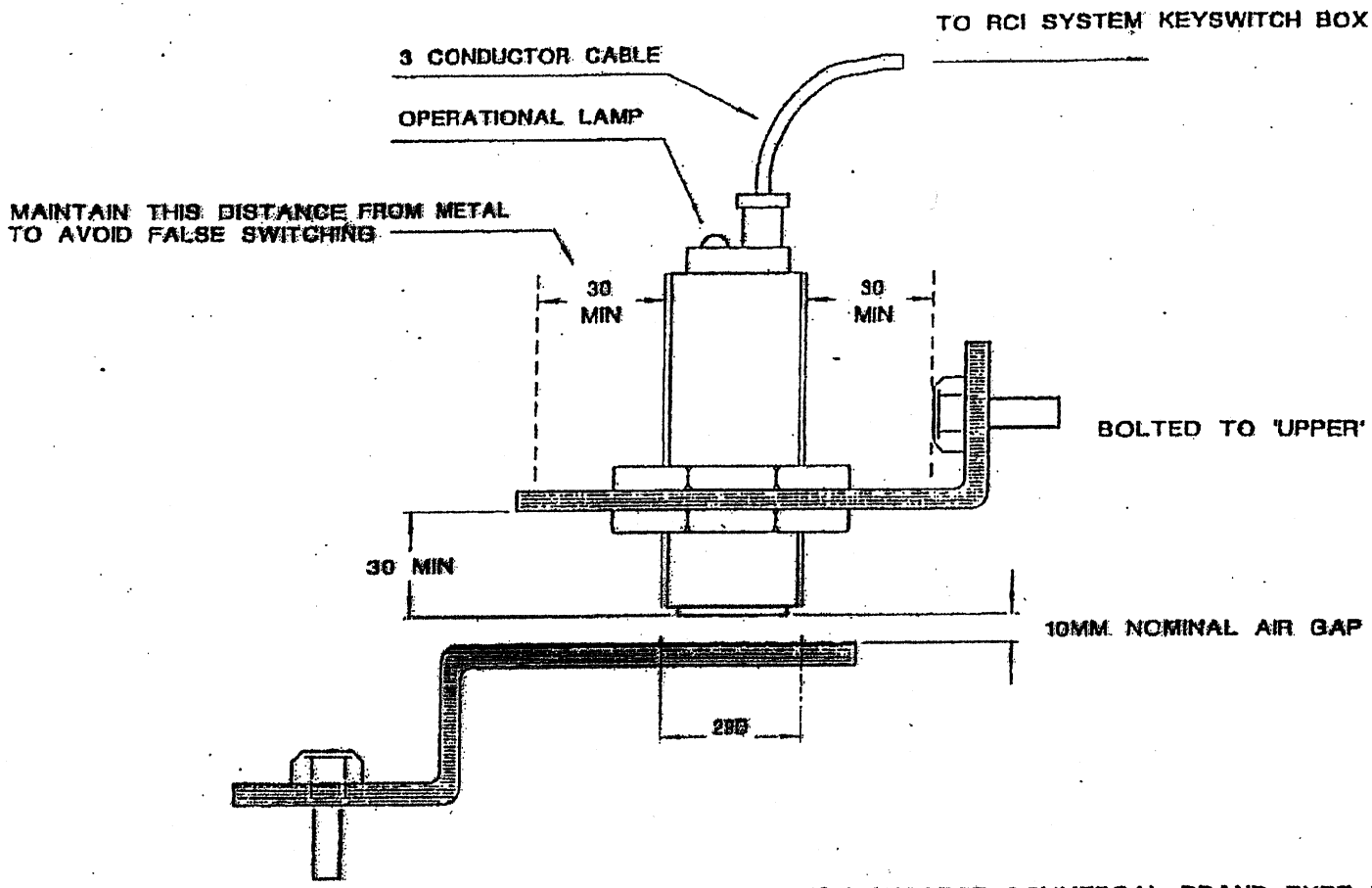
DRAWING No: DWG 2462

FILE No: 246201AA.DWG

REV 1.0

MAN1071C

RCI SLEW SWITCH MOUNTING (WHERE REQUIRED)



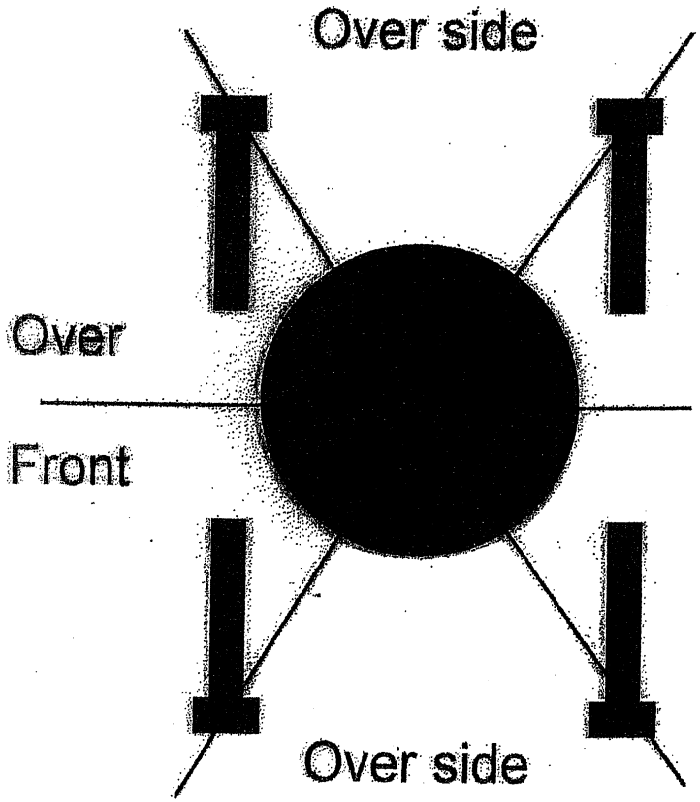
NOTE 1 SUGGEST SCHMERSAL BRAND TYPE IFL 10-30-10ZTPKG

NOTE 1 PROXIMITY SWITCH MAY BE MOUNTED HORIZONTAL

DRAWN: IAW	CHECKED:	DATE: 8.11.93
CUSTOMER: RCI MANUALS		FAB/ASSY/INFO
RCI SLEW SWITCH MOUNTING		DWG: 930050
FILE No: 930050		REV No:

ROBWAY SAFETY SYSTEMS P/L 08 382 8088

Typical Slew/Proximity Switch Application



Switch 1 — opens when over-front

Switch 2 — opens when over-side

Therefore a truth table is;

sw1	sw2	condition
c	c	over-rear
c	o	over-side
o	o	over-front
broken cables		over-front, least capacity.