



PC ROC SOLID MODULAR COMPUTER SYSTEM

TECHNICAL MANUAL



MARCH 2008

INGENIUM TECHNOLOGIES PTY LIMITED
37 BELFORD AVENUE, DEVON PARK, S.A. 5008
TEL + 61(0)8 8245 6789 FAX + 61(0)8 8245 6788

INTERNET: ROC-SOLID.COM.AU

TABLE OF CONTENTS

TABLE OF CONTENTS	2
1.0 Document Overview.....	4
2.0 ROC Modular System Hardware Overview.....	5
3.0 Equipment Technical Description	6
3.1 General Description.....	6
3.2 Computer Unit	6
3.2.1 System Performance.....	7
3.2.2 Input/output	7
3.2.3 Audio.....	7
3.2.4 Display Interface	7
3.2.5 Power Requirements.....	7
3.2.6 Construction.....	7
3.2.7 Mechanical Parameters	7
3.2.8 Thermal Performance	7
3.3 Display Unit	8
3.3.1 Display Unit Parameters	8
3.3.2 Touchscreen Parameters.....	9
3.3.3 Display Power Requirements.....	9
3.3.4 Construction.....	9
3.3.5 Mechanical Parameters	9
3.3.6 Thermal Performance	9
3.4 Remote Power/Reset module	9
3.4.1 Functional Overview.....	9
3.4.2 Mechanical Parameters	10
4.0 System Diagram	11
5.0 Electrical Power Schematic	12
6.0 Mechanical Installation Drawings.....	13
6.1 Computer Unit	13
6.2 Display Unit	14
6.3 System Power/Reset Module	15
7.0 Electrical Cabling Data.....	16
7.1 Cable A Definition.....	17
7.2 Cable B Definition.....	19
7.3 Cable C Definition	21
8.0 External Electrical Interfaces Data.....	23
8.1 Computer Unit Interfaces	23
8.1.1 Power Connection.....	23
8.1.2 Signal Connections	24
8.2 Remote Touchscreen Interfaces	25
8.2.1 Power Connection.....	25
8.2.2 Signal Connections	26
8.3 MOXA Serial Converter.....	27
8.3.1 Power Connection.....	27
8.3.2 USB Connection.....	27

8.3.3	RS232 Serial Connection	27
9.0	System Controls	28
9.1	ROC Computer Unit	28
9.2	Remote Touchscreen Display	28
9.3	System Power/Reset Module	32
10.0	System Maintenance Information.....	33
10.1	Scheduled Maintenance Activities.....	33
10.1.1	Fan Replacement.....	33
10.1.2	Battery Replacement.....	33
10.2	Unscheduled Maintenance Activities.....	34
10.3	Maintenance Tables	34
10.3.1	Scheduled Maintenance Table.....	35
10.3.2	Un-scheduled Maintenance Table.....	36

1.0 Document Overview

This Technical Manual describes the Technical aspects of the ROC Modular Ruggedised computer system. This version of ROC Solid provides a dual remote screen functionality based on the ROC Solid CPU system.

This version of the system has typically been deployed in vehicular mounted applications such as locomotives in use in the freight transportation industries.

The information contained in this document includes:

- detailed technical description of the equipment supplied
- mechanical data including mounting interfaces, installation drawings, equipment outline drawings and thermal requirements
- system electrical drawings & schematic diagrams
- electrical power interface data including power supply requirements, current consumption and thermal dissipation
- interconnect cable data including wire & connector types
- equipment electrical interface definitions
- scheduled and unscheduled maintenance information

2.0 ROC Modular System Hardware Overview

The hardware subsystem described in this technical document has been designed to provide a computing platform to support a range of industrial applications requiring a highly ruggedised computing platform able to support up to 2 touchscreen-displays that can be remoted by up to 40m from the CPU unit.

This technical manual describes the ROC system computing platform based on the ruggedised ROC-Solid computer.

The system offered includes a shock mounted computing unit which incorporates a range of general purpose I/O ports, a remote 10.4" SVGA touchscreen, and a 4 port RS232 serial expansion unit.

3.0 Equipment Technical Description

3.1 General Description

The system described herein is based on the ROC Modular ruggedised computer system, which has been developed to suit the specific operational requirements of Pacific National and fitted to a number of their type NR locomotives.

The system comprises a ruggedised computer system designed for use in severe environments including industrial, mining and scientific applications. Scalable processing performance allows a future upgrade path, along with flexible interface options to accommodate a wide range of system interfaces. An Ultra-low voltage, low power CPU is fitted to minimise heat generation and facilitate location in challenging environments.

The system comprises a shock & vibration mounted computer unit, along with up to 2 remote touchscreen displays that can be situated up to 30 metres from the computer unit. In the configuration described herein, only 1 display is fitted, however the computer module can accommodate 2 displays in the future if required.

3.2 Computer Unit

The ROC computer module comprises a shock mounted enclosure containing the computing electronics and sealable connector bay, as shown below.



3.2.1 System Performance

- Intel Low Voltage Pentium M 1.0 GHz CPU FSB400MHz
- Cache 2nd level 2MByte (Max.)
- Memory 200-pin SO-DIMM 1GB DDR SDRAM
- Chipset Intel 852GM + Intel ICH4
- BIOS Phoenix-Award PnP Flash BIOS
- ATA/IDE Ultra DMA 100, CF/IDE drives supported
- Watchdog Timer 255-level Reset
- Built-in Boot ROM in Flash BIOS
- Program storage 80GB hard Disk Drive

3.2.2 Input/output

- USB Ports 4 x USB 2.0 compliant (one USB port is used by USB to serial converter to provide 4 channels of RS232 serial)
- Keyboard 1 x PS2
- Single Ethernet 10/100 base-T

3.2.3 Audio

- Codec/Interface Realtek ALC655 AC97 Codec, support Line-in/Line-out

3.2.4 Display Interface

- Graphics Chipset Intel 852GM Extreme Graphics2 Engine up to 64MByte
- UMA Video RAM
- Dual VGA Graphics long distance display interface supporting operation to 30m over standard cat 5/6 twisted pair cabling (dual cables per display)

3.2.5 Power Requirements

- Isolated power supply 12v DC +/-5%
- Connection via external screw terminals
- Current consumption 1.4A average (2A peak during startup)
- Additional current required for external USB devices

3.2.6 Construction

- Construction : solid machined anodised aluminium enclosure
- Can be sealed during installation against moisture ingress
- Incorporates anti shock & vibration mounting bracket

3.2.7 Mechanical Parameters

- Mass 2.25Kg (vibration mount tray included)
- Required installation envelope : 260 x 210 x 90mm

3.2.8 Thermal Performance

- ROC Modular computer is rated for 0 – 40 degrees C operation (CPU is thermally bonded to machined case which should be maintained at 40 degrees or less via convection cooling)
- Heat dissipation 14W operating

- Fitted with optional external 12v DC operated cooling fan

3.3 Display Unit

The ROC remote display unit comprises a 10.4" touchscreen display that is connected to the main CPU module via dual cat 5 twisted pair cables (one cable each for display and touchscreen).



The remote ROC display unit requires a 12v DC power supply and also has a facility via a rear connector for controlling the computer RESET and ON-OFF function, and for displaying the POWER status of the ROC Computer.

A rear panel connector also allows screen brightness to be externally set using a panel mounted potentiometer.

3.3.1 Display Unit Parameters

- Screen size : 10.4"
- Resolution : SVGA 800 x 600
- 262K colours (18 bit interface)
- Viewing angle (H/V) 120/100
- Contrast ratio 500:1
- Backlight dual CCFL
- Maximum brightness 400 cd/m2
- Interface : video is via proprietary differential encoded signalling from CPU (utilises a cat 5 cable with standard RJ45 connector)
- Control : all operational parameters via front panel buttons (3)
- Dimmer function : external brightness control via potentiometer

3.3.2 Touchscreen Parameters

- Screen size : 10.4"
- Technology : 5 wire resistive
- Durability : > 30 million operations
- Touch Resolution : 2048 x 2048
- Accuracy : standard deviation of error < 1.5%
- Interface : via cat 5 twisted pair cable (also incorporates power & reset functions)

3.3.3 Display Power Requirements

- Isolated power supply 12v DC +/-5%
- Display current consumption; max 1.1A operating (0.12A sleep mode)

3.3.4 Construction

- Construction : solid machined Aluminium enclosure
- Sealed against moisture ingress

3.3.5 Mechanical Parameters

- Mass 2.5 Kg
- Dimensions 290 x 233 x 43mm
- Flange mounting directly into locomotive driver panel

3.3.6 Thermal Performance

- Display rated to 40 degrees C
- Heat dissipation 14W maximum

3.4 Remote Power/Reset module

3.4.1 Functional Overview

To provide a remotely located system power control and computer reset capability, a separate control module is supplied. This device contains 2 pushbuttons. The POWER button is illuminated green when main computer power is applied.

This module plugs directly into the Remote Touchscreen display via a 6 core cable fitted with RJ12 connectors at each end. The Remote Power/Reset Module is shown below.



The operation this module is as follows:

- Pressing POWER button momentarily will cause Windows to initiate an orderly shutdown and turn the main 5V power off to the computer (this assumes that Windows has been installed with this feature enabled)
- Holding the POWER button for 4 seconds initiated an immediate switching off of the computer (this should be avoided as repeated disorderly shutdown of Windows can cause program corruption).
- Pressing RESET momentarily resets the CPU in the ROC. This would normally only be used in the rare event of a software hang or error.

3.4.2 Mechanical Parameters

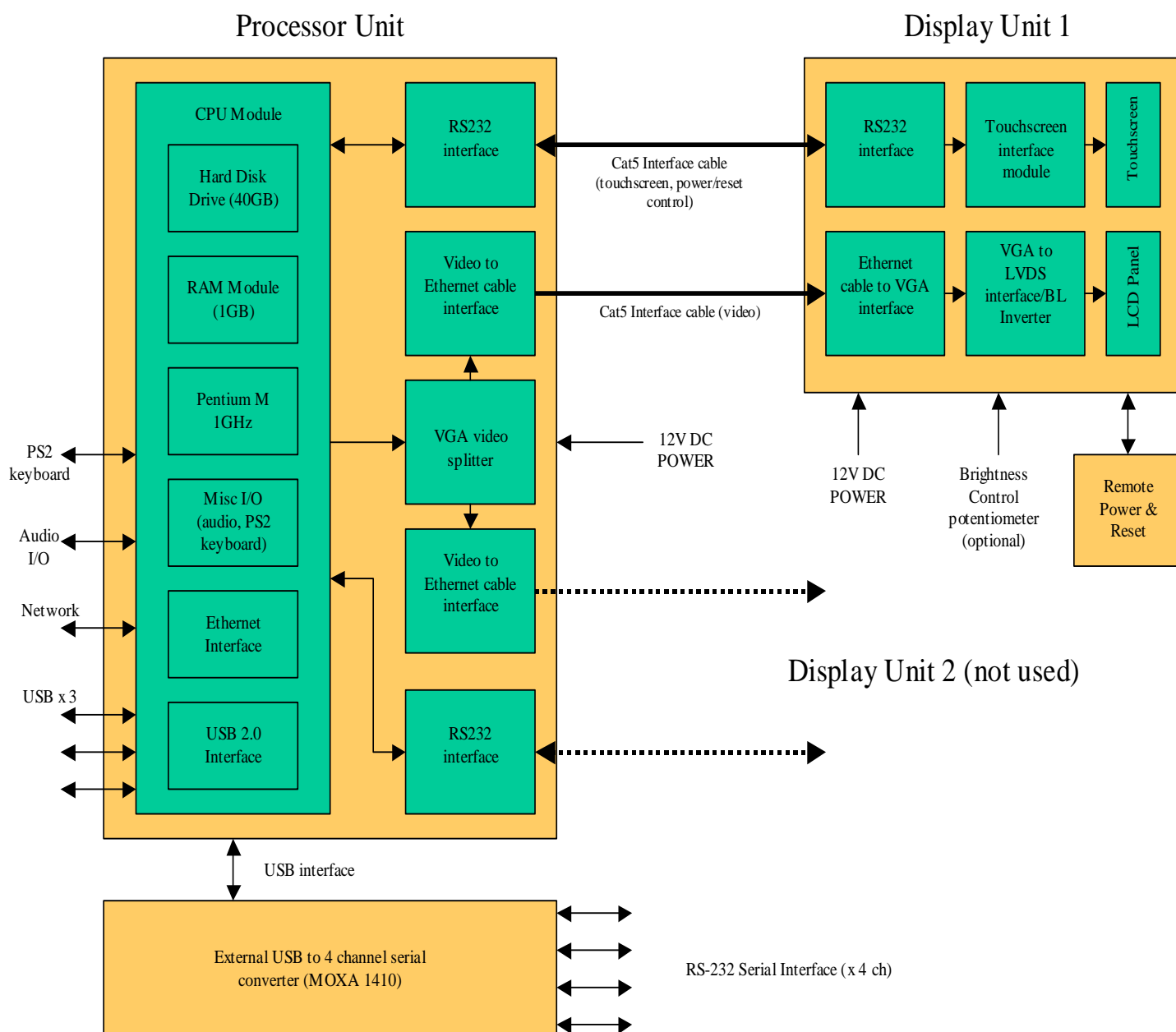
- Mass 20g
- Dimensions 77 x 35 x 24 mm

4.0 System Diagram

The following diagram depicts the system configuration of the Visualisation System as fitted to Type NR Locomotives. The diagram indicates the dual screen capability of the processor module, however only one touchscreen unit is shown connected, as per the configuration of the system under consideration.

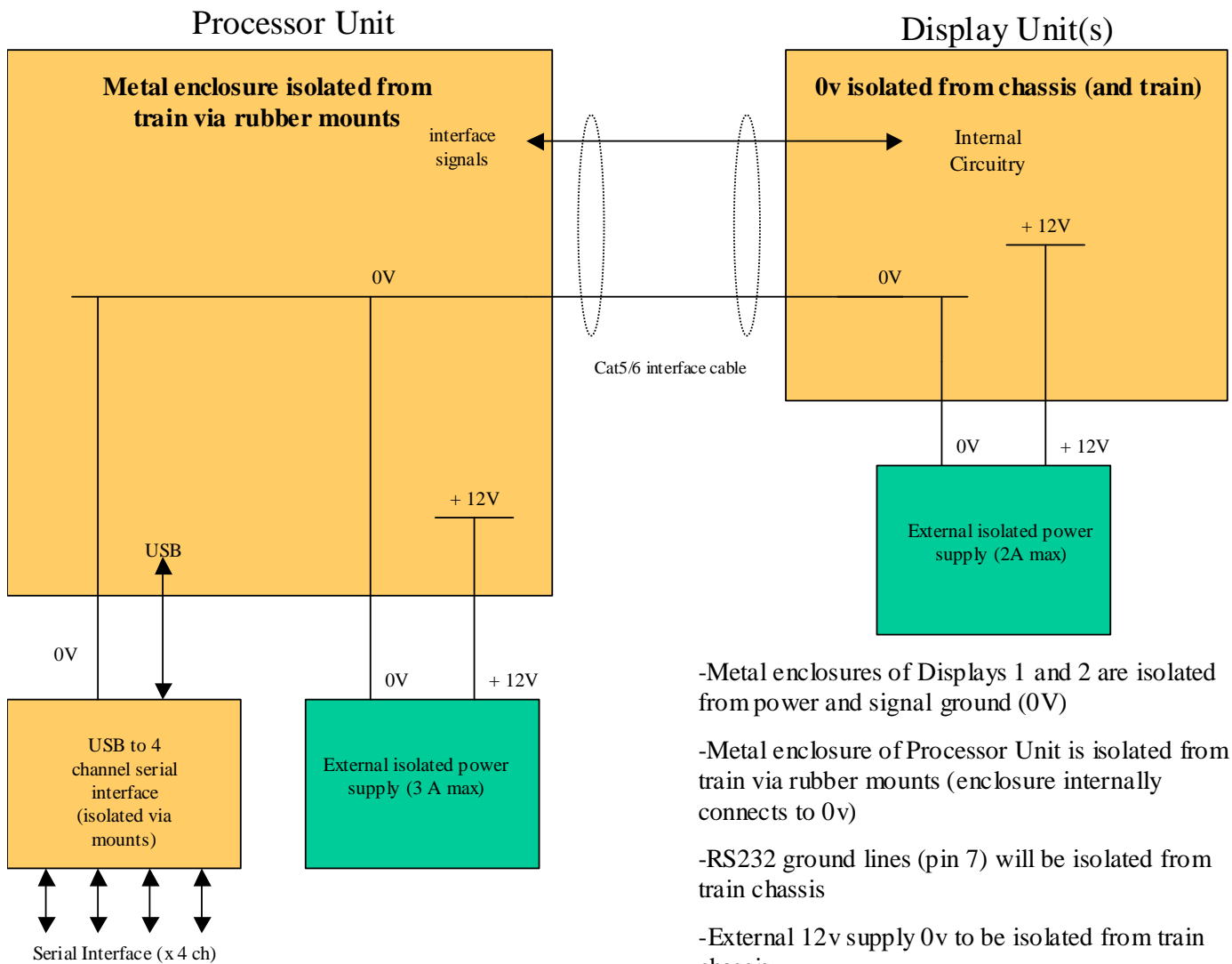
The displays are interfaced to the central computer via a pair of standard Cat5 network type cables fitted with RJ45 connectors at each end.

The display units are also fitted with an RJ12 type 6 way connector that facilitates remote power and reset control of the computer, along with display of the power-on status of the computer.



5.0 Electrical Power Schematic

The following diagram illustrates the electrical interfacing of the ROC based system into the locomotive power supplies.



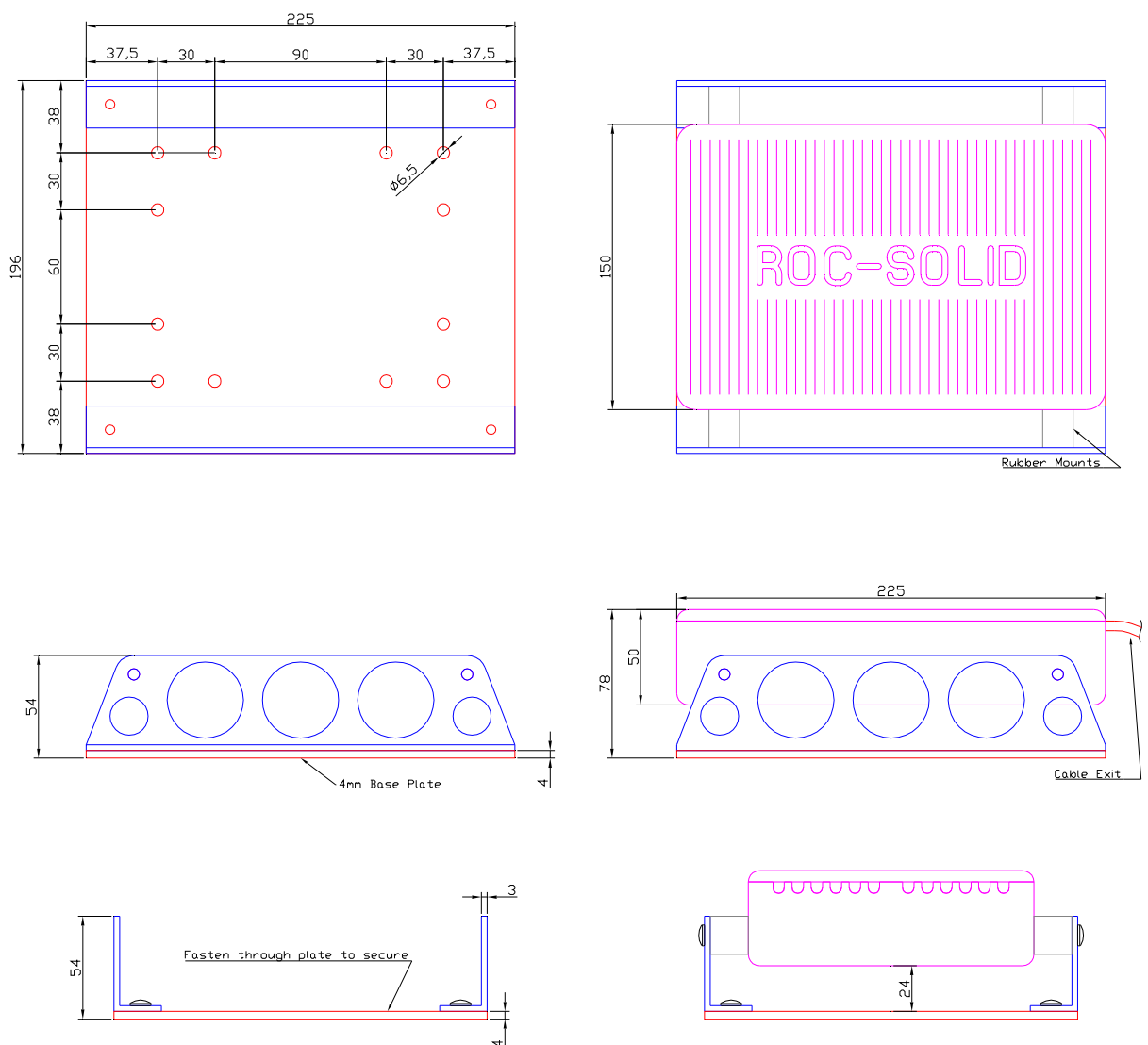
- Metal enclosures of Displays 1 and 2 are isolated from power and signal ground (0V)
- Metal enclosure of Processor Unit is isolated from train via rubber mounts (enclosure internally connects to 0v)
- RS232 ground lines (pin 7) will be isolated from train chassis
- External 12v supply 0v to be isolated from train chassis

6.0 Mechanical Installation Drawings

This section details the mechanical installation parameters and requirements associated with the equipment.

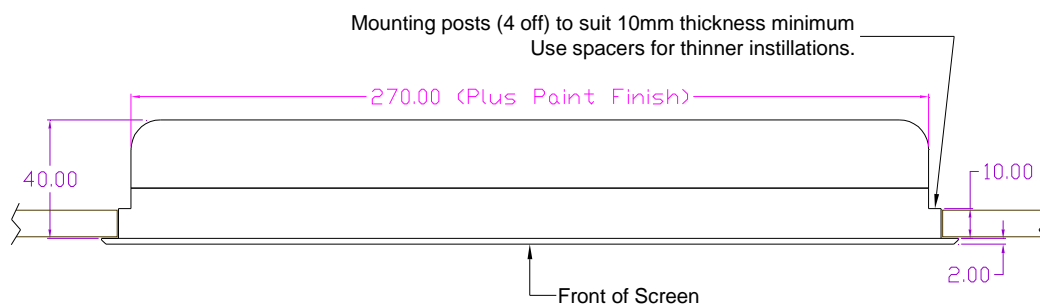
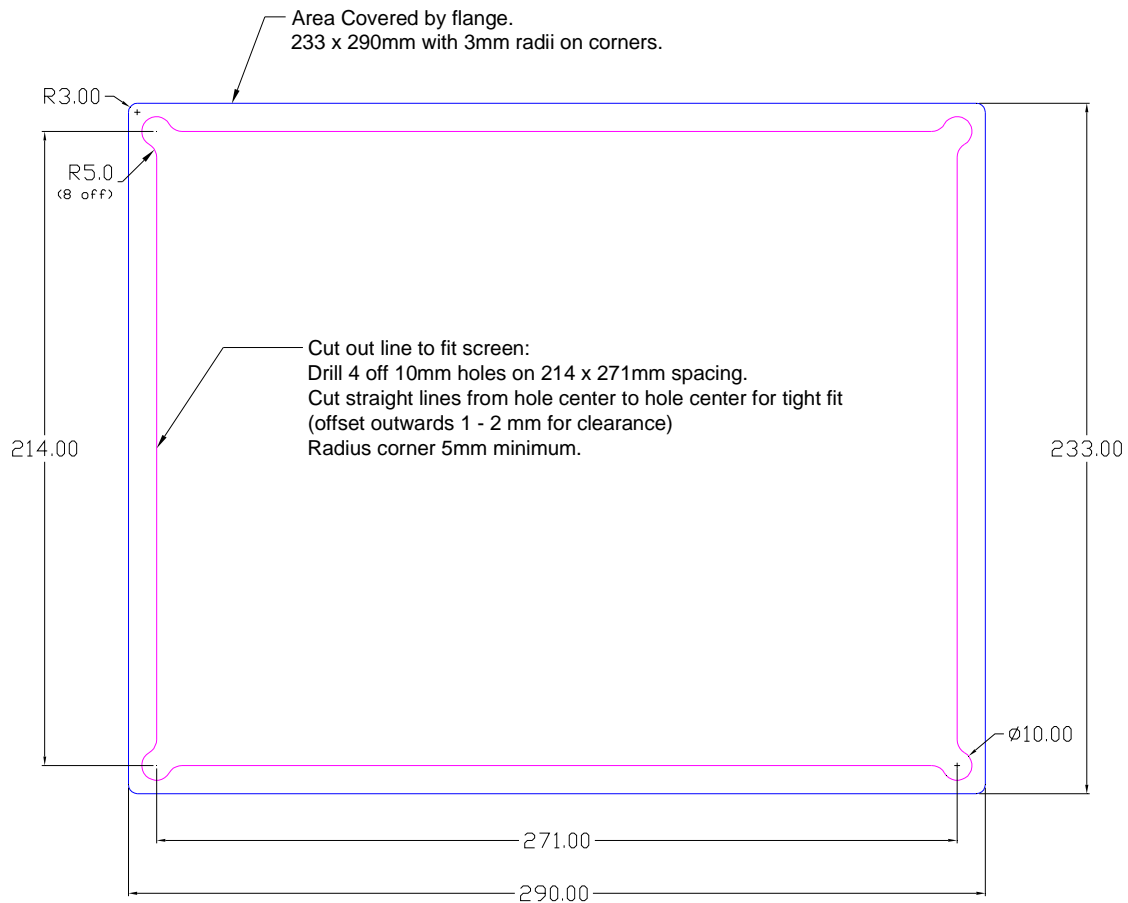
6.1 Computer Unit

The mounting hole positions for the ROC Computer mounting plate are as shown below. To fix the mounting plate, the 4 screws securing the rubber mounts to the computer must be removed first. A total of 12 mounting holes (6.5mm diameter) are provided to secure the ROC Computer mounting plate.



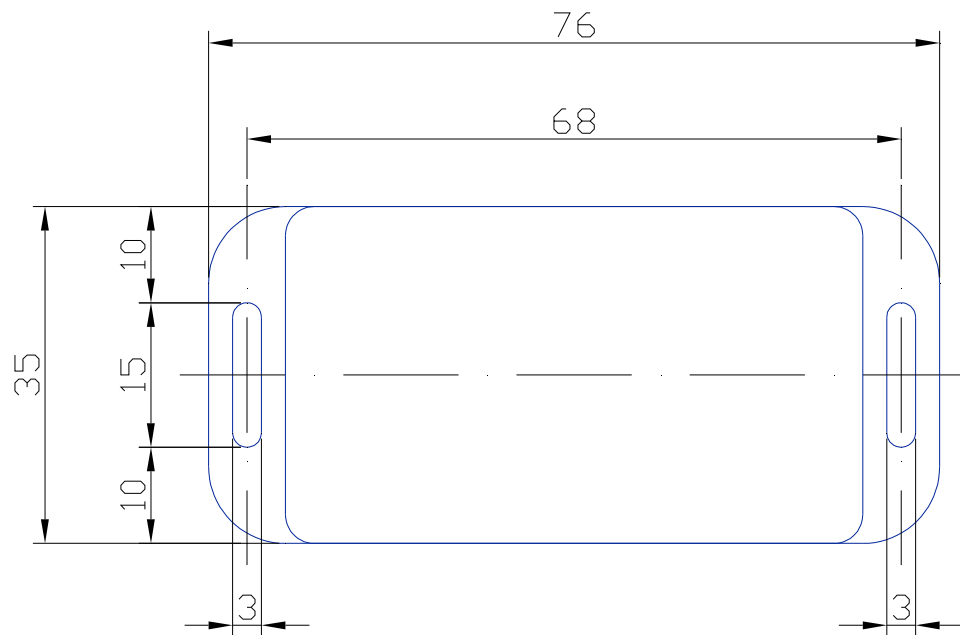
6.2 Display Unit

The panel cutout required to facilitate mounting of the remote display unit is shown below.



6.3 System Power/Reset Module

The overall dimensions and mounting slots for the Remote Power/Reset module are shown below.

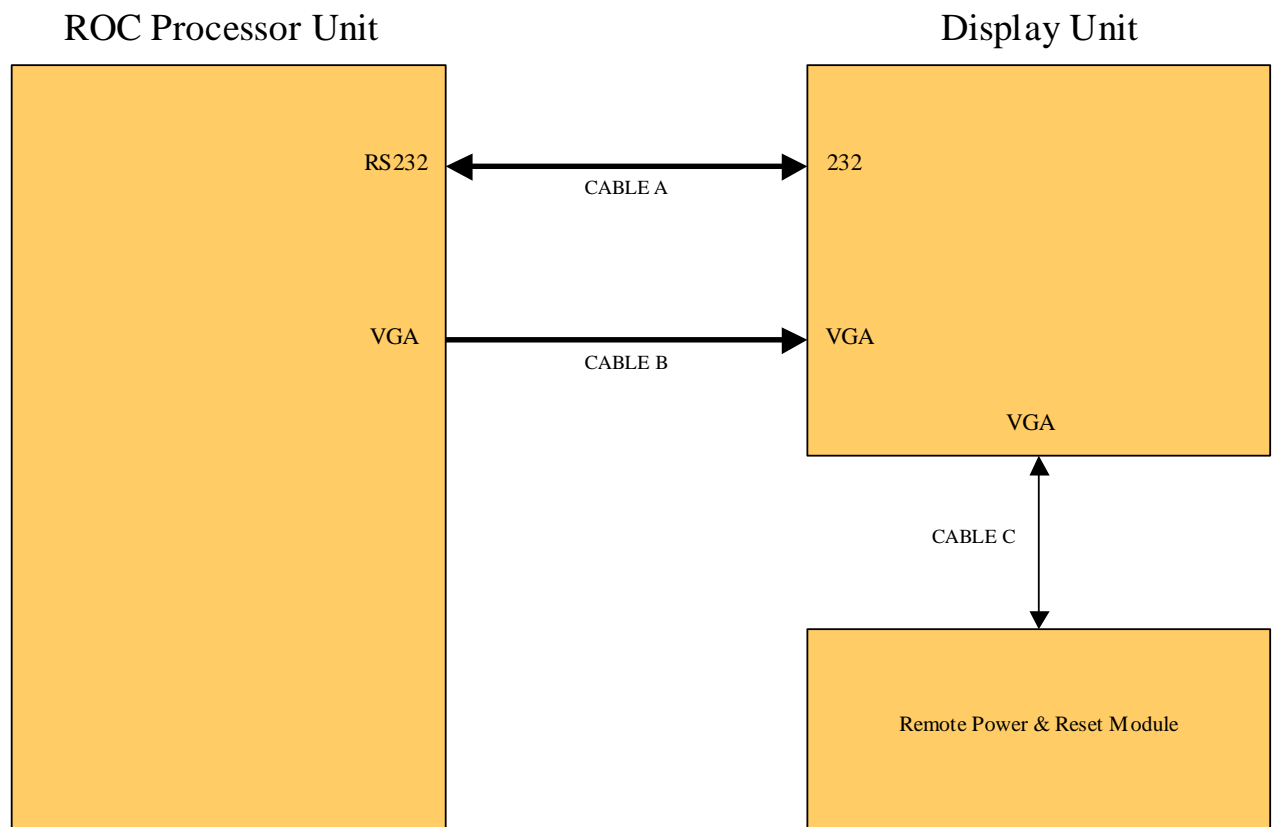


7.0 Electrical Cabling Data

This section details the electrical cables required to interconnect the various components within the ROC Subsystem.

There are 3 interconnect signal cables required to be installed within the locomotive as shown below. These are designated cable A, B and C.

- Cable A provides control and signalling functions between the ROC CPU and the Remote Touchscreen Display
- Cable B provides video display signalling from the ROC CPU to the Remote Touchscreen Display
- Cable C provides signalling between the Remote Touchscreen Display and the Reset/Power Control Module.



7.1 Cable A Definition

This cable connects between:

- ROC Computer Unit, RJ45 connector designated **RS232 (Screen 1)**, and
- Remote Touchscreen Display, RJ45 connector designated **232**.

a. Cable and Connector Definition

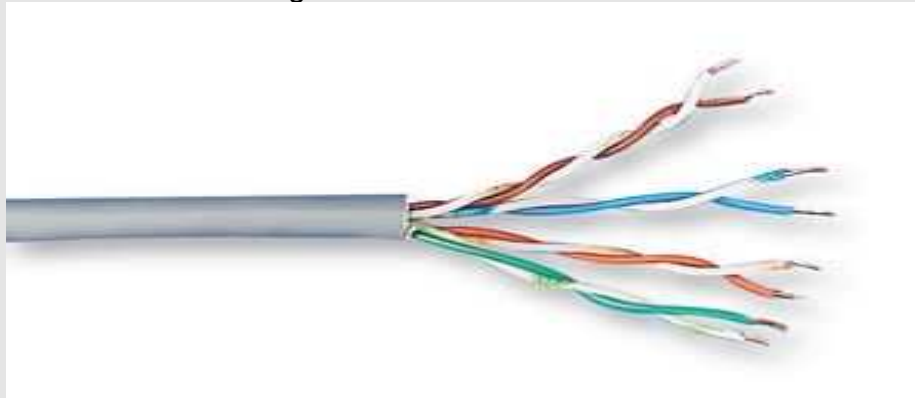
Cable Type : CAT5 UTP, LSZH

Manufacturer : REX

Part No : C5U-HF1

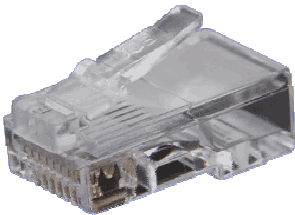
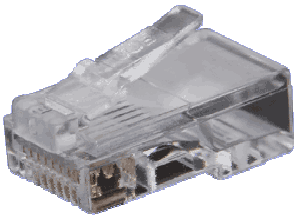
Supplier : Farnell, order code 1182875

Specifications : 8 core, 4 pairs, solid wire 24AWG, 0.2mm conductor area, resistance per metre 0.938R, PVC insulation, grey, ext diameter 4.8mm, impedance 100R. Reel length 305m











ROC Computer Connector (1)

Touchscreen Display Connector (2)

<p>Connector Type : RJ45</p> <p>8P8C Cat5E Plug Modular Round, Solid Cable compatible</p> 	<p>Connector Type : RJ45</p> <p>8P8C Cat5E Plug Modular Round, Solid Cable compatible</p> 
---	--

b. Wiring Table

The following table defines the standard interconnect scheme applicable to CAT5 twisted pair ethernet cables as required for this interface.

RJ45 Pin No, Connector 1	Wire Color	Wire Diagram	RJ45 Pin No, Connector 2	Signal Name
1	White/Green		1	BI_DA+
2	Green		2	BI_DA-
3	White/Orange		3	BI_DB+
4	Blue		4	BI_DC+
5	White/Blue		5	BI_DC-
6	Orange		6	BI_DB-
7	White/Brown		7	BI_DD+
8	Brown		8	BI_DD-

7.2 Cable B Definition

This cable connects between:

- ROC Computer Unit, RJ45 connector designated **VGA (Screen 1)**, and
- Remote Touchscreen Display, RJ45 connector designated **VGA**.

a. Cable and Connector Definition

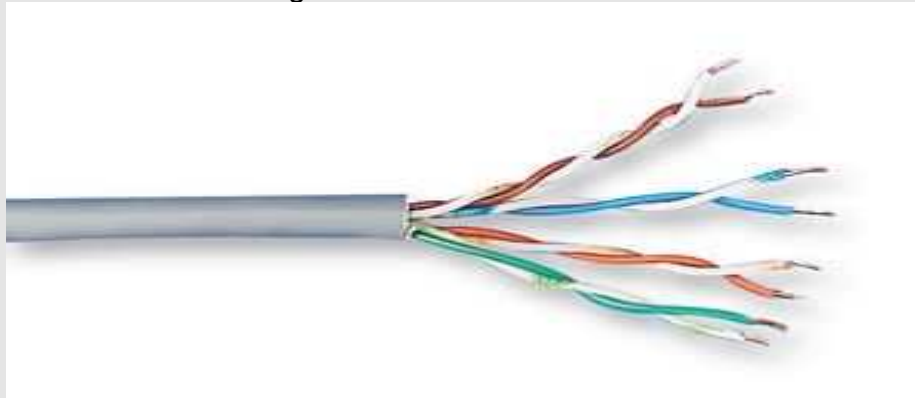
Cable Type : CAT5 UTP, LSZH

Manufacturer : REX

Part No : C5U-HF1

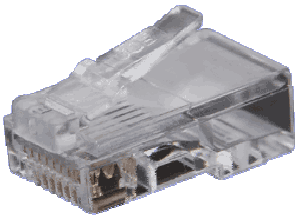
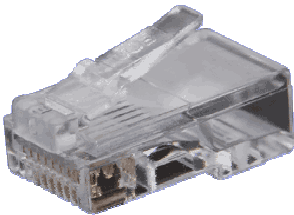
Supplier : Farnell, order code 1182875

Specifications : 8 core, 4 pairs, solid wire 24AWG, 0.2mm conductor area, resistance per metre 0.938R, PVC insulation, grey, ext diameter 4.8mm, impedance 100R. Reel length 305m











ROC Computer Connector (1)

Touchscreen Display Connector (2)

<p>Connector Type : RJ45</p> <p>8P8C Cat5E Plug Modular Round, Solid Cable compatible</p> 	<p>Connector Type : RJ45</p> <p>8P8C Cat5E Plug Modular Round, Solid Cable compatible</p> 
---	--

b. Wiring Table

The following table defines the standard interconnect scheme applicable to CAT5 twisted pair ethernet cables as required for this interface.


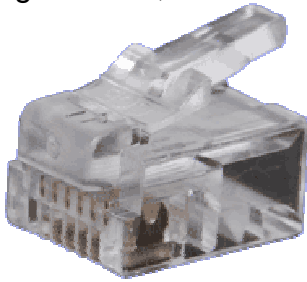
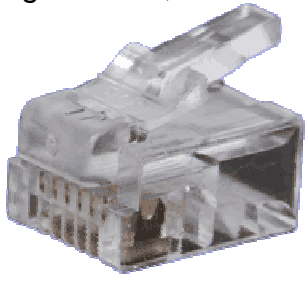
RJ45 Pin No, Connector 1	Wire Color	Wire Diagram	RJ45 Pin No, Connector 2	Signal Name
1	White/Green		1	BI_DA+
2	Green		2	BI_DA-
3	White/Orange		3	BI_DB+
4	Blue		4	BI_DC+
5	White/Blue		5	BI_DC-
6	Orange		6	BI_DB-
7	White/Brown		7	BI_DD+
8	Brown		8	BI_DD-

7.3 Cable C Definition

This cable connects between:







- Remote Touchscreen Display, RJ12 connector designated **REMOTE**.
- Remote Power/Reset Module

a. Cable and Connector Definition

<p>Cable Type : 6 CORE FLAT MODULAR TELEPHONE CABLE</p> <p>Specifications : 6 core, 3 pairs, stranded wire 6 x 7 x 0.12mm</p> 	
Remote Touchscreen Connector (1)	Power/Reset Module Connector (2)
<p>Connector Type : RJ12</p> <p>6P6C Plug Modular, Flat Strand</p> 	<p>Connector Type : RJ12</p> <p>6P6C Plug Modular, Flat Strand</p> 

b. Wiring Table

The following table defines the straight-through 6 way flat modular cable required for this interface.

RJ12 Pin No, Connector A	Wire Color	Wire Diagram	RJ12Pin No, Connector B	Signal Name
1	White		1	Ground
2	Black		2	Power-A
3	Red		3	Power
4	Green		4	Reset-A
5	Yellow		5	Reset
6	Blue		6	+5vCPU

8.0 External Electrical Interfaces Data

This section details the electrical interfacing to:

- The ROC Computer
- The Touchscreen Display Unit
- The Serial Converter unit

8.1 Computer Unit Interfaces

8.1.1 Power Connection

Equipment Connector : Terminal Block		
Mating Connector : not required (direct connection of wire or spade terminal)		
PIN No	FUNCTION	PARAMETERS
1	0v	Connects to isolated 12v supply common to power ROC Computer
2	+12v	Connects to isolated 12v supply +12v output to power ROC Computer

8.1.2 Signal Connections

The signal interfaces are accessed by removing the ROC Computer top cover plate. This provides access to a number of board mounted connectors that are standard with those used throughout the computer industry.

The following table summarises the internal connectors and their function.

ROC Computer Internal Connectors Interface Definition		
DESIGNATION	FUNCTION	PARAMETERS
Screen 1 VGA	Video output	Connects to VGA input of Remote Touchscreen display. Carries differential long-range video signalling information to drive remote display video function.
Screen 1 RS232	Control & signalling	Connects to 232 input of Remote Touchscreen display. Carries control and signalling associated with touchscreen and remote power/reset module.
Screen 2 VGA	Video output	Second screen output - not used in this application
Screen 2 RS232	Control & signalling	Second screen output - not used in this application
Ethernet	Network Interface	Standard RJ45 connector designed to accept Cat5 or Cat 6 interconnect cable
USB 2.0	Dual USB interface connector	Standard USB port, dual channel. One port is used to connect to the MOXA USB to Serial 4 channel serial converter.
Keyboard PS2	Keyboard interface	Accepts a PS2 PC keyboard for system setup and configuration purposes.
Line In	Audio input	Dual channel analog input interface to audio processing element of computer.
Line Out	Audio output	Dual channel analog output interface to audio generation element of computer.

8.2 Remote Touchscreen Interfaces

8.2.1 Power Connection

Equipment Connector : 2.5mm PCB Mount DC Power Socket

Mating Connector : 2.5mm Female DC Plug with Strain relief (shaft length 9.5mm)



PIN No	FUNCTION	PARAMETERS
Outer	0v	Connects to isolated 12v supply common to power ROC Remote Display
Inner	+12v	Connects to isolated 12v supply positive output to power ROC Remote Display

8.2.2 Signal Connections

An external interface is provided to control the screen dimming function using an external potentiometer. This function allows the screen brightness to be easily and quickly dimmed for nighttime use by means of a driver panel mounted potentiometer.

A 3 way terminal block mounted in the rear connector panel of the Touchscreen (adjacent to the “power” button) provides this interface. A 10K linear potentiometer should be connected to these 3 pins as per the following table.

The rating of the potentiometer should be 0.1W or greater.

Remote Touchscreen Dimming Interface		
DESIGNATION	FUNCTION	PARAMETERS
CW (adjacent to “power” button)	Potentiometer clockwise terminal	Connects to the end of the potentiometer associated with full clockwise rotation. Internally connects to display 0v.
Wiper (centre terminal)	Potentiometer wiper terminal	Connects to the wiper terminal of the potentiometer. Internally feeds a voltage to the backlight inverter to set the screen brightness level.
CCW (adjacent to “232” connector)	Potentiometer counterclockwise terminal	Connects to the end of the potentiometer associated with full counter-clockwise rotation. Internally connects to a positive voltage of approximately 10v used to reduce the backlight brightness to minimum.

8.3 MOXA Serial Converter

8.3.1 Power Connection

The MOXA rear panel power connector should not be used as power is supplied to this unit via the USB interface when the unit is plugged into the ROC Computer.

When power is fed via the USB port as per above, it is also important to ensure that the rear panel switch adjacent to the power input is set to the BUS position (and not EXT).

8.3.2 USB Connection

The MOXA USB cable should be plugged into one of the USB ports within the ROC Computer. It is necessary to remove the ROC Computer Cover Plate to gain access to these connectors.

8.3.3 RS232 Serial Connection

The MOXA Converter unit is provided with 4 x RS232 serial interface connectors. These are wired in accordance with the standard RS232 serial interface definition.

9.0 System Controls

The system is provided with a number of operator and maintainer accessible hardware control functions as listed in the following section.

9.1 ROC Computer Unit

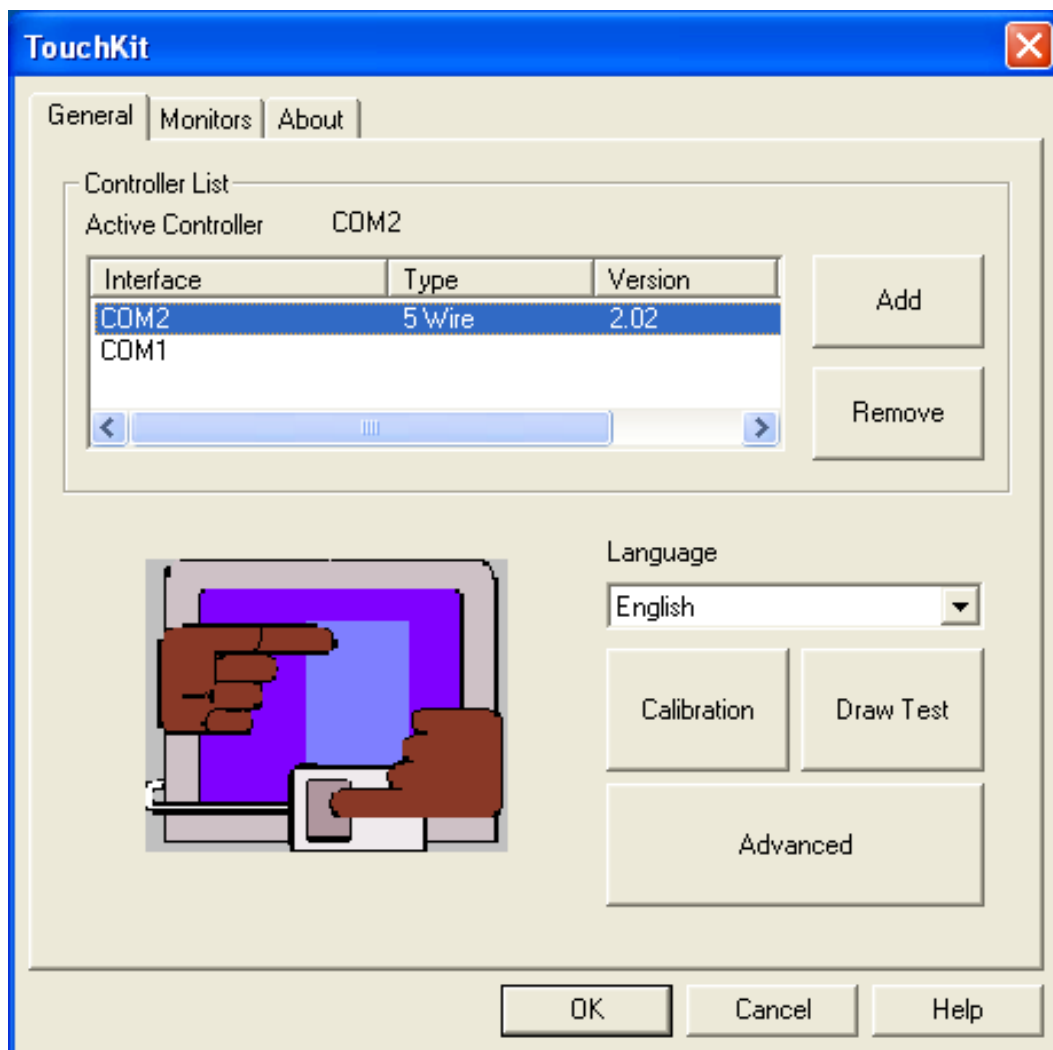
- A Power button is provided inside the ROC Computer. This will normally not need to be accessed if the BIOS auto-restart option has been set. In this case, System power will always be applied whenever main 12v input power is restored.
- Holding the power button down for 4 seconds or more forces an immediate power shutdown of the computer (assuming correct BIOS settings)
- In the event that it becomes necessary to reset the BIOS in the ROC, the following settings should be made:
 - BIOS section 1: Date set; time set; halt on all but keyboard error;
 - BIOS section 2: First boot USB-HDD; second boot HDD-0; floppy seek disable;
 - BIOS section 4.3: Power on after pwr fail;
 - BIOS section 5: Power supply type ATX; soft off 4 sec;
 - BIOS section 6: PNP OS : Yes;
 - BIOS Section 7: Shutdown 70deg C
- Ensure that the Save and Exit option is selected after entering the above parameters.

9.2 Remote Touchscreen Display

- A Power button is provided on the rear connectors panel. This is used to control internal power to display. The status of this button is internally stored so that the display will automatically restart following any interruption to power. Ensure that the power is initially toggled to ON.
- An Optimise button is provided on the rear connectors panel. This button should be pressed following system installation to allow the timing parameters of the display to be optimised to the video drive signals produced by the computer. In the event that the display shows any jitter or blurring, this button should be pressed to initiate calibration and allow the system to optimise the remote display quality.
- The 3 buttons on the Remote Display front panel allow other display parameters such as color, contrast, and screen brightness to be set. These will not normally need to be adjusted, however if any settings are required to be altered, the menu can be accessed by pressing the centre button designated MENU. Using the < and > arrow buttons, along with the

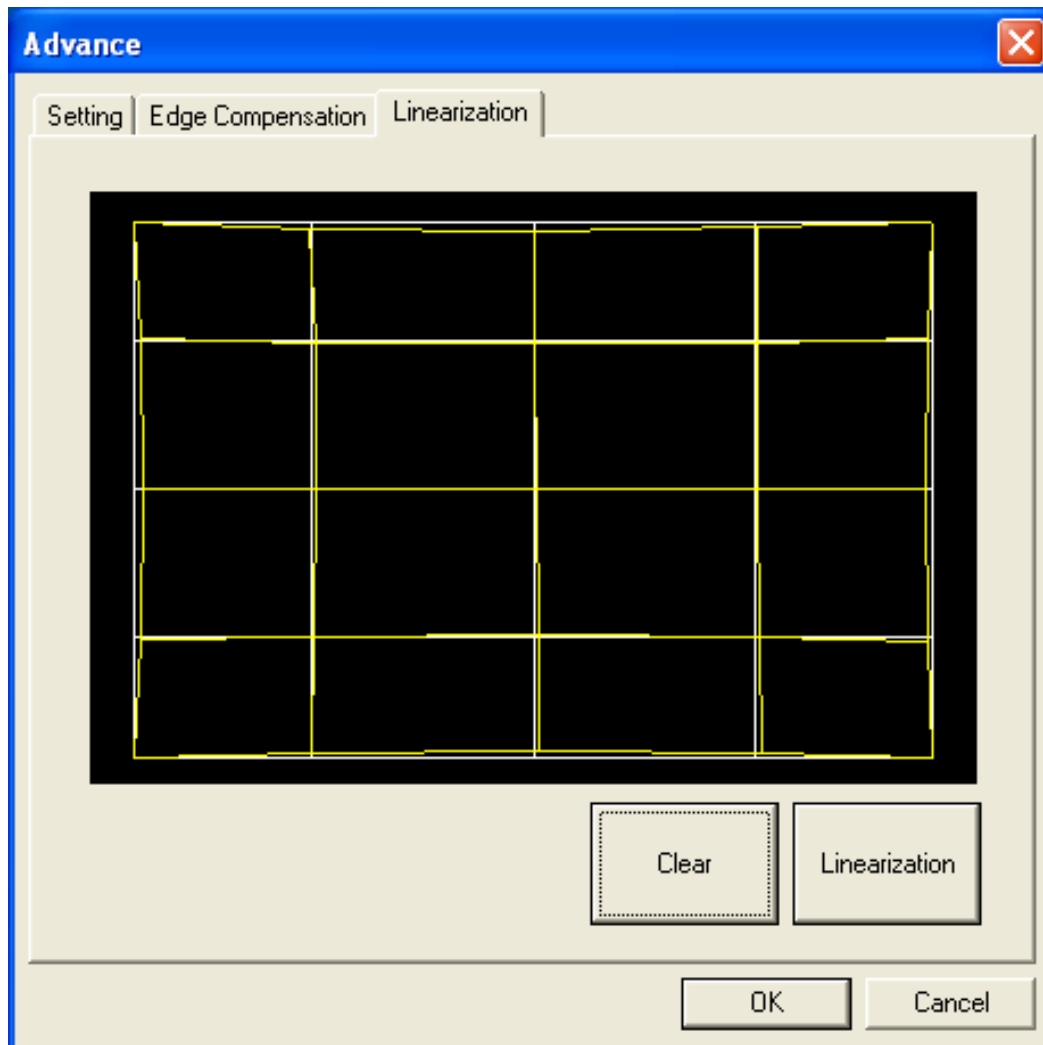
MENU button, and following the on screen instructions allows a variety of screen parameters to be modified and saved.

- It is necessary to calibrate the touchscreen after installation, and to configure various parameters such as mouse emulation modes.
- Touchscreen setup is undertaken using the *Touchkit* program accessible via the Windows desktop. To setup the touchscreen:
 - Activate the Touchkit program from the Windows desktop. The following screen will be displayed.

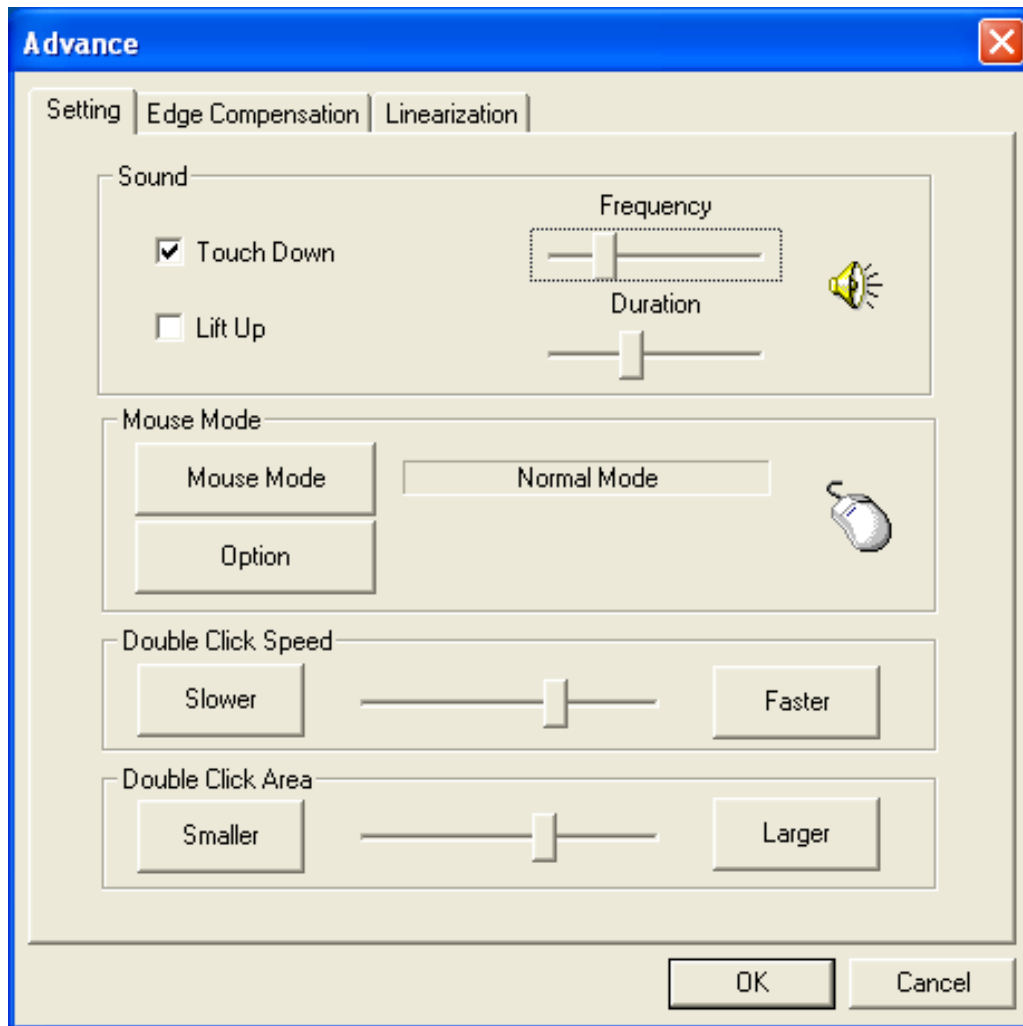


- If more than one touchscreen controller has been installed (eg for dual screen systems), it will be shown in the Controller List above. Select the serial interface relating to the touchscreen to be calibrated (eg COM2 in the above example). This will correspond to the ROC display connector (ie RS232-1 or RS232-2) that the display is plugged into.

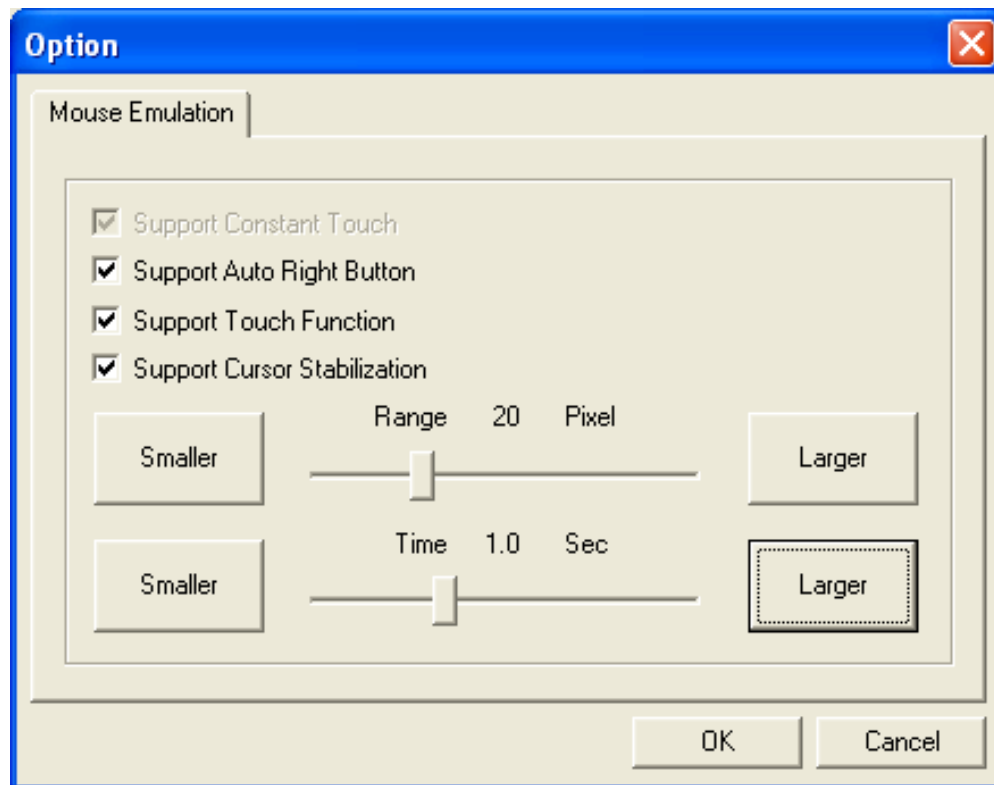
- To undertake a simple and rapid 4 point calibration, select *Calibration*, and follow the on-screen prompts. A total of 4 screenpoints will be used to calibrate the touchscreen.
- It is recommended that prior to final system commissioning a more accurate 25 point calibration is undertaken. To do this, select *Advanced* in the above menu. The following screen will be displayed:



- Now select *Linearization* and follow the on-screen prompts. A total of 25 screen points will be used to establish screen calibration parameters.
- To setup mouse emulation and various other modes, select *Advanced* from the main Touchkit menu. The following screen will be displayed:



- Select the required *Sound* parameters, and *Double Click Speed* and *Double Click Area* parameters.
- To select Mouse emulation modes, select *Option* in the above menu. The following menu will be displayed:



- The above screen shot indicates suggested parameters to enable right button emulation and recommended values for the other parameters.
- Following the setup of the touchscreen options, close the *Touchkit* window. The parameters will be written to the system disk.
- Note that parameters are stored on the system disk attached to the screen, therefore if a screen is swapped out it may be necessary to repeat the calibration process again.

9.3 System Power/Reset Module

- The Power button allows an orderly shutdown of the ROC Computer. Provided that the software has been correctly configured, pressing this button will initiate a shutdown of the operating system. This method of shutdown should always be used prior to removing main power in order to avoid possible corruption to the operating system software.
- Holding the power button down for 4 seconds or more forces an immediate power shutdown of the computer (assuming correct BIOS settings)
- A LED indicator within the Power button indicates the power-on status of the ROC computer. A green indication signifies the presence of main 5v power in the computer.
- The Reset button provides a hard reset of the computer hardware. This may need to be activated in the event of a system error causing a non-responsive condition in the operating system or application software.

10.0 System Maintenance Information

10.1 Scheduled Maintenance Activities

The following maintenance activities should be undertaken at the indicated schedule.

10.1.1 Fan Replacement

Although the ROC cooling fan is of ball bearing type and is rated for 100,000 operating hours (at 25 deg C), it is recommended that at 1 yearly intervals the fan is checked for correct operation. If the fan appears to be faulty (eg unusual sounds, dirty, damaged or clogged) replace the cooling fan as follows:

- Remove the ROC Computer chassis from anti-vibration mount by removing the 4 screws securing the rubber mounts and lifting the computer outwards.
- Remove the fan by unscrewing the 4 x M4 x 20mm screws, and disconnecting the fan connector from the power interface board.
- The replacement fan type is : Sirocco XC5055, 50mm, 12v DC ball bearing type
- To refit fan, reverse the above procedure. Ensure that the 4 x M4 screws are fitted correctly so that the fan is held tightly at the correct height from the CPU chassis. The fan should be located approximately midway between the ROC rear casing and the bottom of the anti-vibration mount.

10.1.2 Battery Replacement

The ROC Computer utilises a Lithium battery to maintain CMOS memory parameters during periods of system power removal. Although the battery has a theoretical lifetime in excess of 100 years based on current consumption in this application, the battery may (depending on environmental and storage conditions) need replacement earlier. As a preventative measure, it is recommended that the battery be replaced every 5 years, or earlier if indicated by any on-screen message displays that may appear. To replace battery:

- Remove the ROC Computer case cover plate.
- Disconnect the battery connector from the circuit board, and unclip the battery and remove from ROC.
- The replacement battery type is : Tadiran TL-5242W (3.6v)
- To reinstall battery, reverse the above procedure. Ensure that the battery is well secured within the clip and velcro retention strip provided.
- In order to maintain memory contents and avoid having to reset these parameters, the above procedure can be carried out with ROC power applied. Care should be taken however to ensure that no internal items of circuitry are short circuited if this method is used.

- As CMOS memory batteries typically contain Lithium, any disposal instructions shown on the battery should be adhered to.
- Following CMOS battery replacement, it is recommended that the computer BIOS setting be checked to ensure that memory has not been altered during the battery replacement process (a PS2 keyboard will need to be connected to the ROC computer keyboard port during system restart to enable access to BIOS settings to be gained).

10.2 Unscheduled Maintenance Activities

Any failure within the ROC computer or display electronics will usually be indicated by specific on-screen error messages, or complete lack of system operation.

Any faults occurring in the system are diagnosed by swapping out the suspected faulty unit with a replacement module from the hardware items table provided in Section 10.

As the PC Visualisation system is also heavily dependent on the Windows Operating System software, in addition to a number of custom designed applications programs, fault diagnosis of an apparent system malfunction must also take into account the operational parameters and interactivity of this software suite.

10.3 Maintenance Tables

Further maintenance data is supplied in the following Tables.

10.3.1 Scheduled Maintenance Table

SCHEDULED MAINTENANCE INTERVALS		Maint Strat	Planned Maintenance		No of Items per loco	Insitu Maintenance			Workshop Maintenance		Comment	Reliability
Code	Item		Timing	Interval		Maint Duration	Man-hours	Crew Size	Duration	Man-hours		
1	ROC Computer											
1.1	CMOS Memory Battery	I	Cal years	5	1	1	1	1	-	-	Preferred component changeout	If CMOS battery fails and then system power is lost, system configuration parameters will be lost with likely impact on correct operation of software.
1.2	Cooling Fan	I	Cal years	1	1	1	1	1	-	-	Preferred component inspection interval	If fan fails and system is subjected to excessive heat levels, overall system reliability may be adversely impacted.

10.3.2 Un-scheduled Maintenance Table

Item		Failure Mode	Reliability		Repair			Category				In-situ Repairs			Workshop Repairs	
	Description		Timing	Interval				1	2	3	4	Repair Duration	Man-hours	Crew Size	Repair Duration	Man-hours
1	ROC Computer															
1.1	Cooling Fan	Stops rotating	Op hrs	100,000	I	1	1		X			1	1	1		
1.2	Hard Disk	Data storage errors occur	Op hrs	100,000	UX	1	1	X							Return to supplier	
1.3	CPU module/interface board	System error or fault indicated	Op hrs	200,000	UX	1	1	X							Return to supplier	
1.4	CMOS memory battery	One or more I/O devices not functioning	Cal years	5	I	1	1	X				1	1	1		
2	Remote Display															
2.1	Touchscreen	Inoperative touchscreen	touches	10M	UX	1	1	X							Return to supplier	
2.1	LCD Display	Backlight-inverter fail	Op hrs	25,000	UX	1	1	X							Return to supplier	
3	Serial Expander Unit															
3.1	Serial Ports	One or more serial ports not functioning	Op hrs	400,000	UX	1	1	X							Return to supplier	
4	Remote Power-reset Module															
	Control port	Power and/or reset buttons not functioning	Op hrs	50,000	UX	1	1			X					Return to supplier	