CHICAGO X-RAY RAYOS SKANRAY

CHICAGO X-RAY RAYOS SKANRAY DC

High Frequency Intra-Oral X-Ray System

INSTALLATION MANUAL

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Contents

1 Symbols in this Manual

This manual contains information related to installation. Safety tips to prevent unwanted X-ray exposures, physical injury and proper functioning of the equipment are provided. The manual covers debugging of anticipated problems and their correction. Location and meaning of the various labels are provided.
The following are guidelines for using this manual.

	Caution! This symbol draws the attention of the reader to a caution in the operation of the unit. Pay particular attention to these points as they are related to safety.

2 Introduction

This manual describes how to install the Rayos DC Intra Oral X-ray system (Wall Mount). Read this manual carefully and refer to it for any installation on the equipment.

	Installation has to be done by an authorized and competent individual. • Failure to do so could result in injury or harm to the operator and patients. • Failure to do so will compromise warranty terms and conditions. • Since the radiation Safety requirements vary from Country to Country and State to State it is the responsibility of the installer to ensure that the local and national Safety regulations are met.

The manual also contains list of spare parts and ordering information. A recommended Tools list is included so that the Installation / Service Engineer can be well prepared for executing the procedure.

3 Scope

This manual is applicable to the RAYOS DC Intra oral X-Ray System (Wall Mount) and its variants as per Chart given below.
This manual covers installation of the X-Ray unit only and does not cover accessories ordered and shipped separately.
This Manual does not cover the usage of the equipment for which the Product User Manual has to be referred.

Product	Part#
RAYOS DC, FS04, WM, 15” Support Tube	303-000134-80
RAYOS DC, FS04, WM, 24” Support Tube	303-000134-81
RAYOS DC, FS04, WM, 33” Support Tube	303-000134-82

4 X-Ray Equipment

Rayos DC is a high frequency intra-oral X-Ray System with an extra-oral X-Ray source for dental diagnostic radiography. The system houses two microprocessors, one for control / supervisory functions and another for man-machine/user interface. The technology incorporates feedback circuits to ensure accuracy & reproducibility of X-Ray output.
The system contains components that need precision installation.

5 General Safety Tips

- This X-Ray equipment may be dangerous to the patient and the operator unless safe exposure factors and operating instructions are observed.
- The X-Ray unit should be assembled and installed by qualified service personnel.
- The unit contains and generates high voltages. Only a trained service personal should attempt to open the protective plastic covers or repair the unit.
- Follow proper X-Ray radiation safety rules.
- Follow instructions specified in this manual when carrying out exposures during service.
- Do not use non prescribed exposures.
- Always cover the X-Ray port with Lead Cup during exposures of service procedures.
- Ensure there are no Patients or other person near the machine when exposures are being done.
- Always be at a distance of more than 2 meters away from the tube head while carrying out exposures.
- Exercise caution when operating and installing the mechanical suspension arm. The arm is spring loaded and can bounce out if proper installation/service procedures are not followed.
- Where complete safeguarding of the equipment is not possible, due care must be taken to ensure that no part of your body or clothing can be trapped or injured by any part of the equipment. In particular, make sure that fingers are not caught or pinched during scissor arm movement.
- Ensure proper Electrical grounding. A bad grounding can be dangerous for the operator and can generate malfunctioning of the X-Ray equipment.
- Wait for at least 5 minutes after mains power off before opening and accessing the covers. During this time, remove the mains plug from the wall socket.

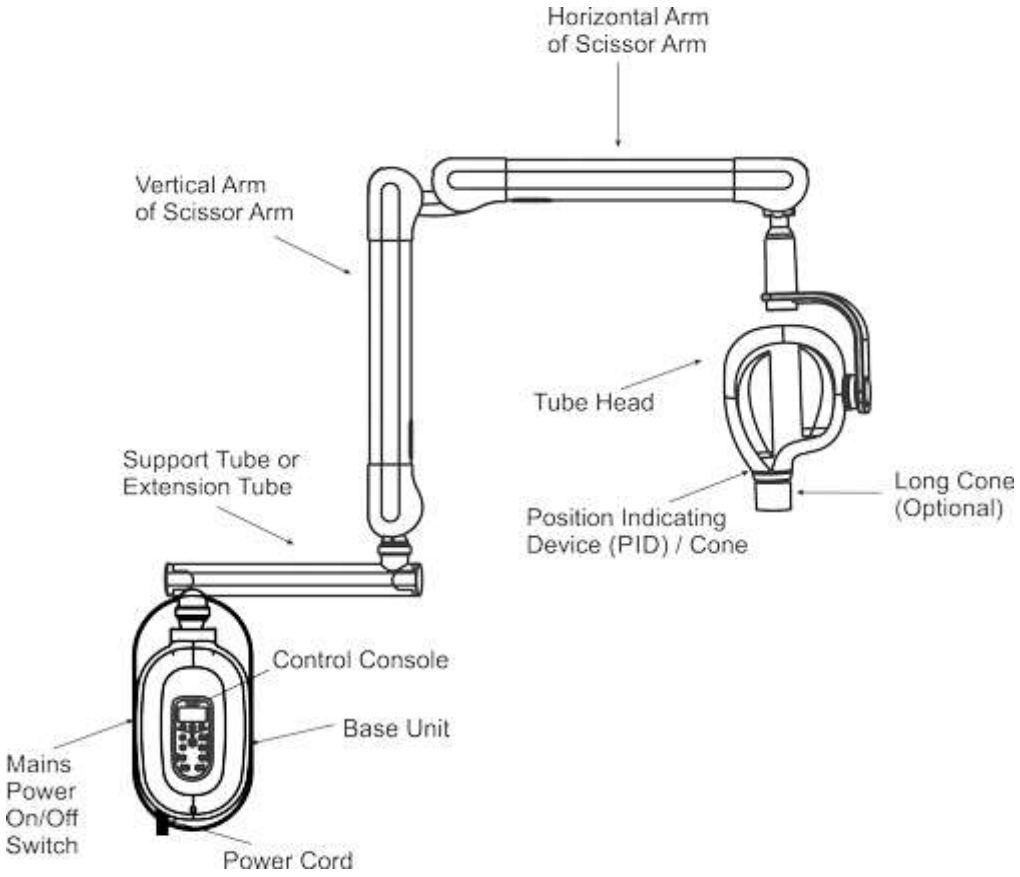
6 Components of the X-Ray unit

6.1 X-Ray System Components

The RAYOS DC X-ray system consists of the following major components.

- X-Ray Tube Head
- Base Unit
- Control Console with cable
- Support Tube (Length Varies)
- Scissor Arm
- Mains cord with compatible plug
- Position Indicating Device (PID)
- Long Cone (if purchased)

6.2 Identification of Main Parts



7 Identification of Labels

7.1 Safety Symbols

The following safety related symbols are found on the equipment.

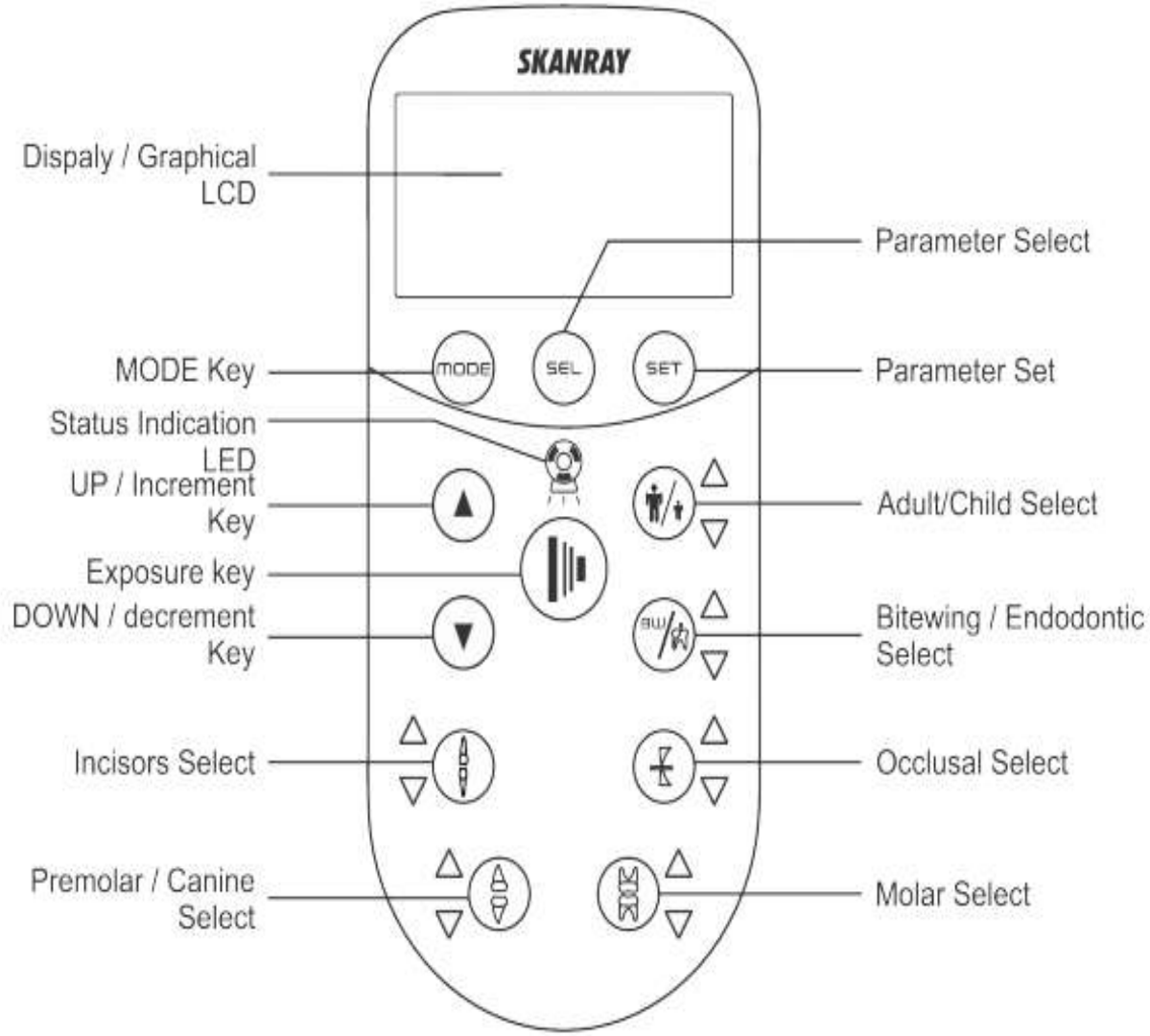
	**Caution Symbol** This symbol indicates the user to be cautious and refer to the user manual.
	**Protective Earth** Mains Earth is required for continued protection against shock hazards.
	**Type of Insulation** Class 1, Type B Insulation. Protection against electric shock (UL60601-1:2003). Requires protective Earth Connection.
	**High Voltage** Dangerous voltages present.
	**Caution: X-Ray** X-Ray Source Assembly / Tube Head capable of generating X-Rays. This X-Ray unit may be dangerous to patient & operators unless safe exposure factors and operating instructions are observed.
	**Focal Spot**
L	**Mains Line Connection**
N	**Mains Neutral Connection**
	**WEEE Symbol** Follow proper procedures for disposing this equipment. Cannot be disposed as general waste.
	**X-Ray Emission /ON**

7.2 Labels on Products

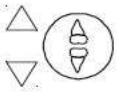
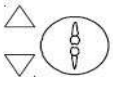
Please refer the respective Product User Manuals for the list of labels and its location where it is fixed on the product.

8 Control Console Identifications

8.1 Control Console Buttons



8.2 Symbol Details (On the Console)

	**Status Indication LED** No Indication: Idle State / Standby Green: Ready to deliver X-Ray Orange: Exposure in Progress Red: Fault
	**Exposure / Prep key** First press of this key will initialize X-Ray tube preparation. Once the READY mode is reached, pressing this button will initiate an exposure.
	**UP/DOWN** Increment / Decrement keys Scroll through a menu Change parameter value
	**MODE** key Cycle through image receptor types. (Film, Digital etc)
	**Select** Key Select a parameter for change Select the displayed value
	**Set** Key Set a selected parameter Set a selected MODE
	**Adult / Child** Select Toggle between Adult or Child exposure settings Up arrow LED indicates Adult. Down arrow LED indicates Child
	**Bitewing / Endodontic** Select Select Bitewing exposure settings (up arrow LED) Select Endodontic exposure settings (down arrow LED) When LEDs are off, neither are selected
	**Occlusa**l Select Parameters corresponding to imaging Occlusal imaging are selected. OCCLUSAL is selectable only if BITEWING/ENDODONTIC is set to none. Up arrow for upper teeth and down arrow for lower teeth
	**Molar** Select Parameters corresponding to imaging Molar teeth are selected Up arrow for upper teeth and down arrow for lower teeth
	**Premolar & Canine** Select Parameters corresponding to imaging Canine teeth are selected Up arrow for upper teeth and down arrow for lower teeth
	**Incisor** Select Parameters corresponding to imaging Incisors teeth are selected Up arrow for upper teeth and down arrow for lower teeth

For detailed description of above buttons refer the Product User Manual.

9 Technical Specifications

Refer Product User Manual for technical specifications.

10 Service Tools

Given below is the consolidated list of the Service Tools & Consumables, which are required for executing the procedure in this manual.

Tools
Hand held Drilling Machine (during Installation) with 4mm, 8mm,14mm & 18mm concrete drill bits
4mm or 5/32” wood drill bit for wall plate
Paladin Crimping Tool with Dies 2035 crimping tool
Box spanner (17mm)
L type Allen Key set
Screwdriver set (Phillips & Flat)
Jewel Screwdriver set (Phillips & Flat)
Nose Pliers & Cutter
Surface level
Tweezers
Nut Driver 5mm & 5.5mm
Soldering Iron
Digital Multimeter (DMM)
Dead Man switch connector Jig for Calibration
Round spirit level
Spirit Level (Long with 3 indications)
Measuring Tape
ESD Wrist wrap
Lead cup for blocking cone
Consumables
Gloves for applying Grease
Grease(Tribocor-White assembly paste) & Waste Cotton
Insulation Tape (if required for Trouble shooting)
Solder (Lead) (if required for Trouble shooting)
Cable Ties & Mounts (if required)
Non Erasable Permanent Marker Pen
Non-Insulated Ferrule / Dowel Stud for wiring

11 Installation

11.1 Site Preparation

Site Survey	• Ensure that the wall for mounting is strong enough for the installation & meet the support load requirement as below
	  • The Rayos DC is designed to mount on a single wood 4" x 4" wood stud and two wood 2" x 4" wood studs that are spaced 16" on center and drywall or equivalent wall support.
	  • The wall support and mounting hardware for the Rayos DC must withstand 150 pounds shear load, and a withdrawal force at each of the mounting bolts of 800 pounds.
	  • The wall fabrication and attachments to the building structure must be capable of withstanding a load moment of 1100 pounds.
	• Make sure that wall is levelled in both vertical and horizontal direction. Use a level indicator as shown in Figure 1 and Figure 2 below.
	• If the wall is not level, unit to be installed using additional 16" wall plate (optional) and to be levelled by inserting shims as required between 16" wall plate and base unit plate.
	• There shall be no wiring conduits running around the area to be drilled for the bolts. In case of wooden walls the wooden columns location should be identified before installation and the fixing should be done within the column area of the wall.
	• Recommended mounting location of the Base Unit on the wall is from the floor level should be as mentioned in the procedures. However this can change based on site condition provided such that it does not affect the functionality of the system.
	• The location should allow sufficient space for movement of the arms in the extended condition.
	• The location should be such that it is possible to use the Dental X-Ray Unit with ease for all possible imaging procedures on the patient with respect to the patient chair location.

Installing Environment	• The unit is designed for indoor usage. • It shall not be subject to direct sunlight for expanded duration. • Mount it away from sources of liquid ingress. • If the X-Ray unit is stored below 10°C, time must be allowed for X-Ray unit to reach room temperature (keeping in room temperature) before connecting it to the mains power. • Make sure that wall is levelled in both vertical and horizontal direction using surface level. • Make sure that there shall be no electrical wiring conduits running around the area to be drilled for the installation bolts.
Electrical Outlets & Requirements	• The mains outlet should have a good Ground connection. Grounding of the system must be checked before connecting the unit. • Additional wiring required for the site must done by a qualified electrician. All wiring should conform to requirements provided by the User manual. • The mains outlet should be capable of supplying 16A (110V) of current. It shall have fuse protection or provided with a circuit breaker of 16A (110V). • It is recommended to have an ELCB (Earth Leakage Circuit Breaker) for protection against earth leakage.

Figure 1

Figure 2

11.2 Unpacking

The Rayos DC Intra oral X-Ray system arrives at the customer site in disassembled condition within the packing box. The packing is in corrugated boxes with inner foam lining. Follow the procedure below for unpacking and checking each sub-assembly.

Ensure there are no visible transit damages. Open the packing box of the Unit shown in Figure 3, by cutting the binding straps using a cutter.

Note: - Check whether all the sub assemblies and hardwares are available in packing box as per packing list. If not, get the missing parts before starting Installation.

Remove the parts available at the top two layers inside the packing box and keep aside.

	Be careful while lifting the Scissor arm. Do not remove the mechanism, which holds the scissor arm in folded condition till the procedure asks for doing so during Installation. Hold both the arms of the Scissor-Arm assembly simultaneously while lifting.

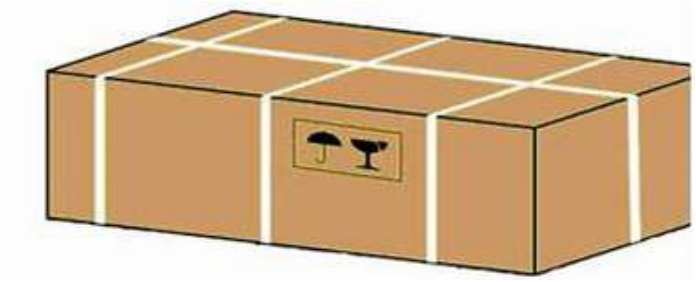


Figure 3

11.3 Mounting the Base Plate

RAYOS DC Wall mount Unit comes packed in Single stud mounting configuration. Follow the steps mentioned below to fix the base unit.

11.3.1 Single Stud Mounting

11.3.1.1 Marking the Drill Locations:

- Fix the base unit on the 4"x4" wood stud as per the steps given below:

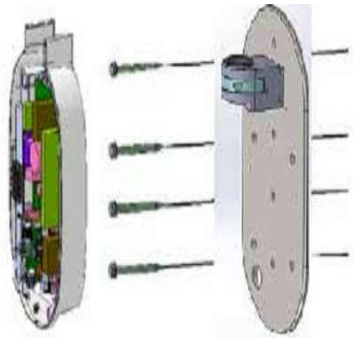


Figure 4:Exploded view of base unit in single stud fixing

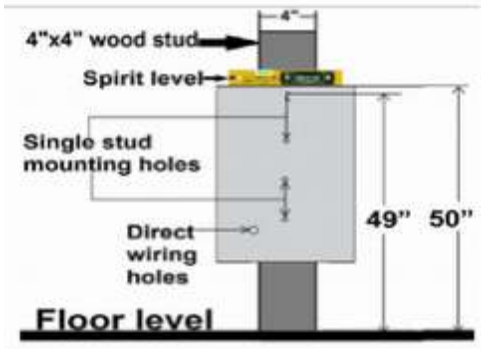


Figure 5:Mark and drill 4 mounting holes using 5/32-inch wood drill bit.

- Place the template on the wall aligning to the centre of the 4”x4” wood stud as shown in Figure 5.
- Place the template such that the top surface of the template is at the height of 50" from the floor.
- Ensure the level of template using spirit level.
- Mark the 4 drilling points and wiring hole.
- Drill pilot using 5/32" wood drill bit to the depth of 4” approximately.
- Drill the wiring hole.

11.3.1.2 Base Plate Mounting:

- Install power and control wiring, following all local codes for electrical work. Pull out the power cable and communication cable(if used) from the wall.
- Route the input power cable and communication cable(if available) through the hole provided for wiring on the base plate and fix the base plate on the wall with 4no's of M10 wood screws along with M10 plain washer using 17mm box spanner as shown in Figure 6. Do not tighten the screws completely.
- Using level indicator check and adjust the level of the base plate as shown in Figure 7. Reconfirm the level and tighten all the wood screws using 17 mm box spanner as shown in Figure 8.

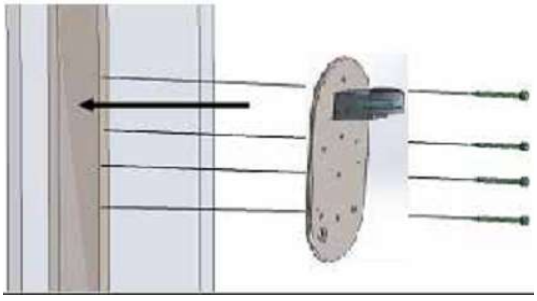


Figure 6:Fixing of Base Plate

Figure 7:Fixing of Base Plate

- Fix the base unit to the base plate with 6no's of M3x10 socket head screws and M3 plain washers using 2.5mm Allen key as shown in Figure 9 .
- Fix the ground wire coming from Bearing block to the ground location with M3x6 HSHC screw and M3 plain washer using 2.5mm allen key as shown in Figure 9 Reconfirm the level of the base plate.

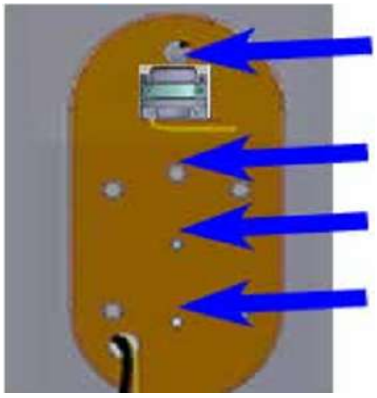


Figure 8

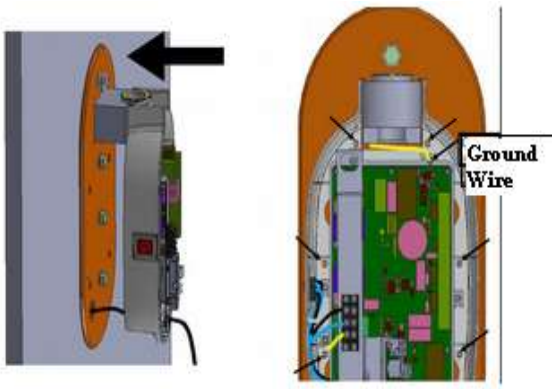


Figure 9

11.4 Two Stud Mounting (Optional)

- Install the RAYOS DC using the 16-inch on center mounting configuration method by performing the following procedures.

11.4.1 Marking the Drill Locations

- Place the template on the wall aligning centre of the 2 x 2”x4” wood studs as shown in Figure 11.
- Place the template such that the top surface of template is at the height of 50” from the floor.
- Ensure the level of the template using sprit level as shown in Figure 11.
- Drill pilot holes at 6 locations for fixing wall plate using 5/32” wood drill bit to the depth of approximately 4”.

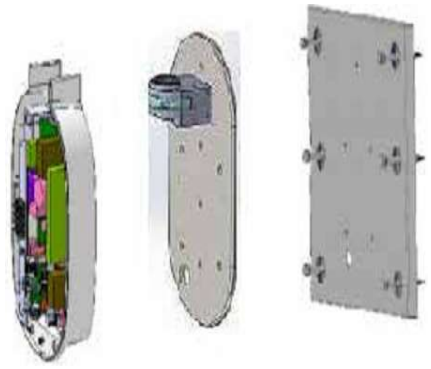


Figure 10:Exploded view of base unit parts in two stud mounting.

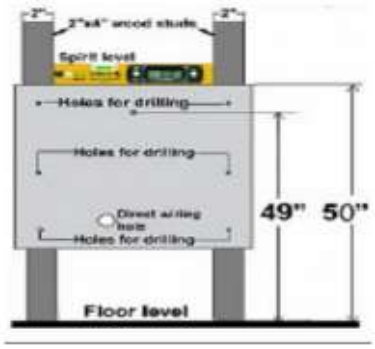


Figure 11:Mark and drill 6 mounting holes using 4mm or 5/32” wood drill bit.

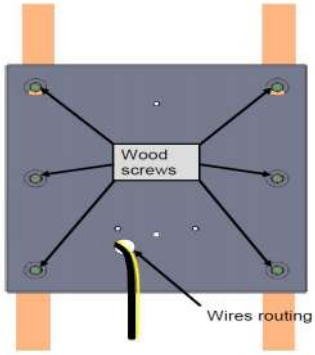


Figure 12:Fix optional plate with 6 lag screws using 17mm box spanner.

- Drill the wiring hole.
- Remove M3x10 HSHC screw from the plate using 2.5mm allen key as shown in Figure 16.
- Route the input power cable and communication cable(if used) along with the optional plate grounding wire through the wire routing hole as shown in Figure 16 and fix the optional wall plate on the wall with 6 no, s M10x80 wood screws and M10 plain washers using 17mm box spanner. Ensure the plate is level and tighten completely using 17mm box spanner.
- Fix the optional wall plate on 2 studs with M10X22 wood screws using 17 mm box spanner.

11.4.2 Drilling Operation

If unit fixing is on Wooden wall, then the mounting holes (6 Holes) location should coincide with strong wooden pillars behind the wooden wall. Drill pilot holes on the wooden wall using drilling machine with 4mm / 5/32” wooden-drill bit to a depth of 4”

approximately at the holes mentioned for drilling.

Note: After drilling all the holes, the wall powder should be cleaned up in all the holes. Failed to do so may result in weak joint between the Base Unit and the wall leading to potential damage to the equipment.

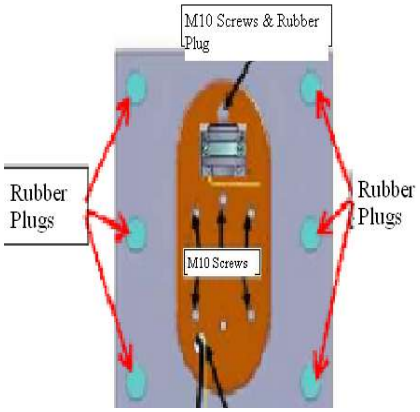


Figure 13

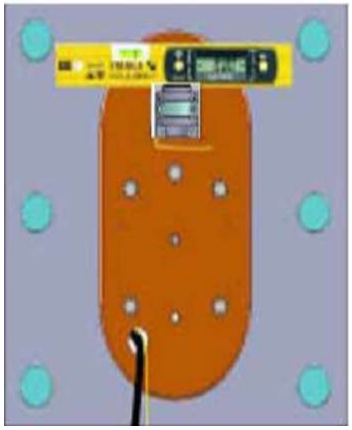


Figure 14

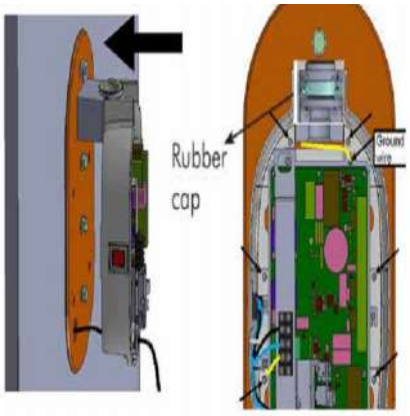


Figure 15

- Fix the base unit plate to optional plate using 6no's of M10 x 22 Hexagonal head bolts along with M10 washers using 17 mm box spanner as shown in Figure 13.
- Check the level of the base plate and tighten the screws using 17mm box spanner as shown in Figure 14.
- Fix the base unit to the base plate with 6no's of M3x10 socket head screws and M3 plain washers using 2.5mm Allen key as shown in Figure 15.
- Fix the rubber plugs at all the screw locations as shown in Figure- 13.

11.4.3 Procedure for Input Wiring for the Units Where Input Power Cord (Factory Assembled) is not Used

- Using the Paladin Crimping Tool with Dies 2035 (shown in Figure 18), crimp the three dowel studs(shown in Figure 16) to the Line, Neutal and Ground wires of the Input power cable coming from the wall.
- Remove the cable clamp used to hold the Power cord shown in Figure 18 by removing 2 Hexagonal Socket Head Cap screws (M3x4). Strip the insulation on each of the wire ends for a length of approximately 5mm.
- Pull the Input power Cable (with Line, Neutral & Ground Leads) coming from the wall through the hole inside the Base Unit and through the hole provided on the power board strip as shown in Figure 19.


Figure 16

Figure 17

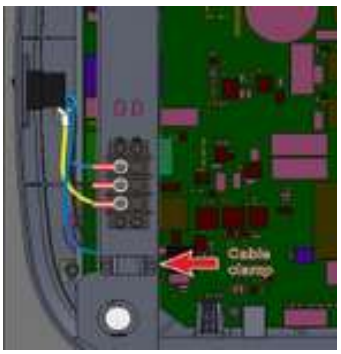


Figure 18

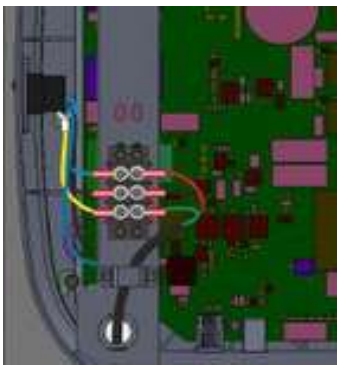
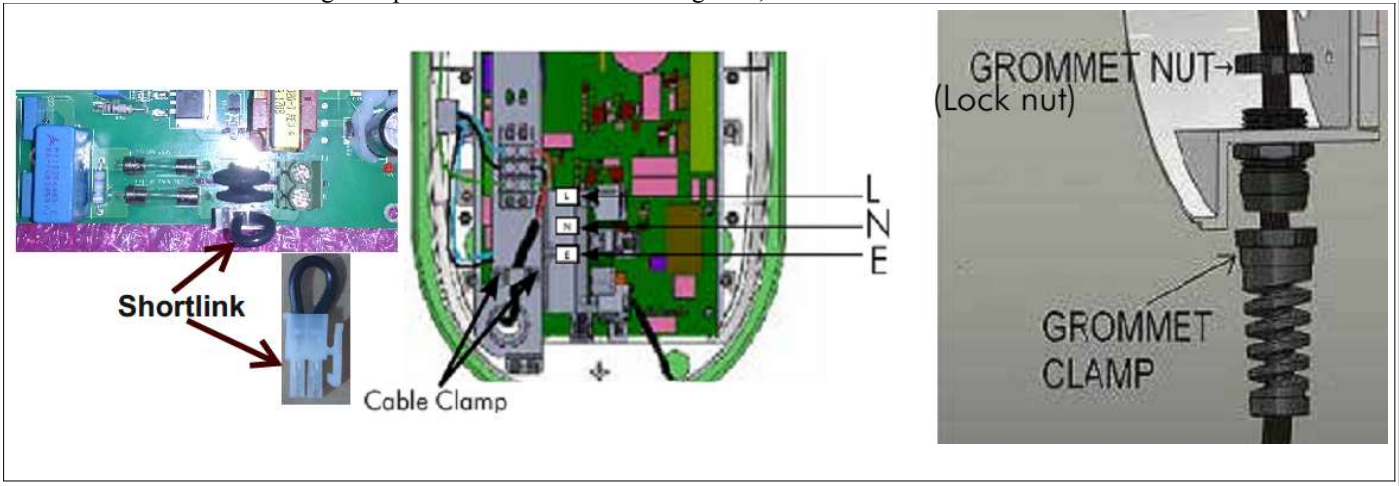


Figure 19

- Using Flat screw driver to fix the input power cord wire terminals coming from the wall to the terminal block such that
- Line wire matches with label “L”, Neutral wire matches with label “N”, and Earth wire matches with label “E” as shown in Figure 19.
- Fix back the cable clamp holding the cable with two numbers of M3x6 screws using 2.5mm Allen key as shown in Figure 19.

11.4.4 If Factory Supplied Power Cord(Not assembled with the unit):

- Take out the power cord assy from the packing box.
- Insert power cord into the base unit bottom cover.
- Insert & tighten the lock nut into the cable, fix dowel insulated lug coming from power cord to the Live(Black), Neutral(White) & Grounding(Green) on terminal block using flat screw driver.
- Lock the locking nut to the cable gland pigtail of power cord.
- Fix the stress releving clamp on the terminal block using 2 no, s of M3x4 HSHC Screws.



Note: If the Input Supply is 100-110V, then ensure to connect Jumper (Shortlink- which is available at C-Clamp on TB holder) on Power Board at J6 location. (Jumper(Shortlink) not required for 230-240V input supply)

11.5 Straight Arm / Support Tube Installation

- Take the straight-arm and remove the M6 stopper screw using 5mm Allen key and keep it separately Figure 20 .
- Loosen the 2 no's of M4 x 16 HSHC screw at the location shown in Figure 21. by using 3mm Allen key(Ensure free movement of Friction clamp while inserting Straight Arm), Route the guide wire (straight Arm) and ground wire through the slot of Bearing Block and mount the Straight Arm on the Base unit Bearing Block.
- Tighten the 2 no's of M4 x 16 HSHC Screws at the location shown in Figure 21 by using 3mm Allen key ensuring the smooth movement of straight arm.
- Check and confirm the level of the straight-arm using spirit level by rotating to all directions as shown in Figure 22. If not level, vertical leveling can be done by adding shims between optional wall plate and base unit plate.
- Check the level of the straight arm as shown in Figure 22.
- Horizontal leveling can be done by tilting the base unit plate.

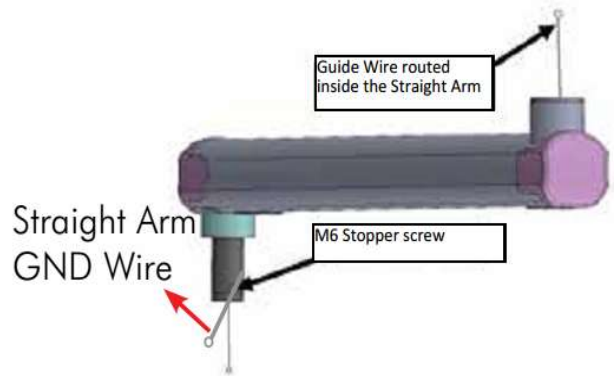


Figure 20

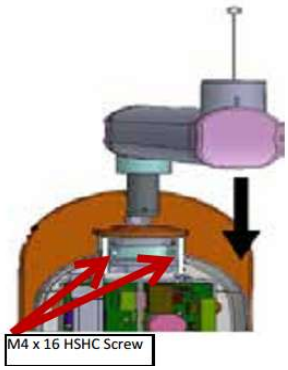


Figure 21

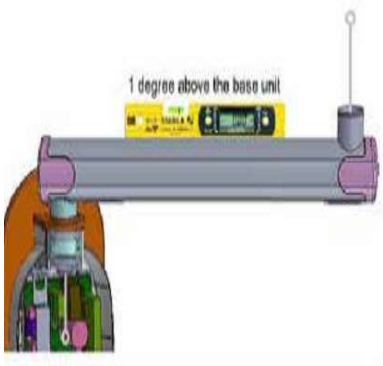


Figure 22

- Connect the Ground wire (Straight Arm) to the ground point as shown in Figure 22 *(A) and* Figure 22 *(B)*

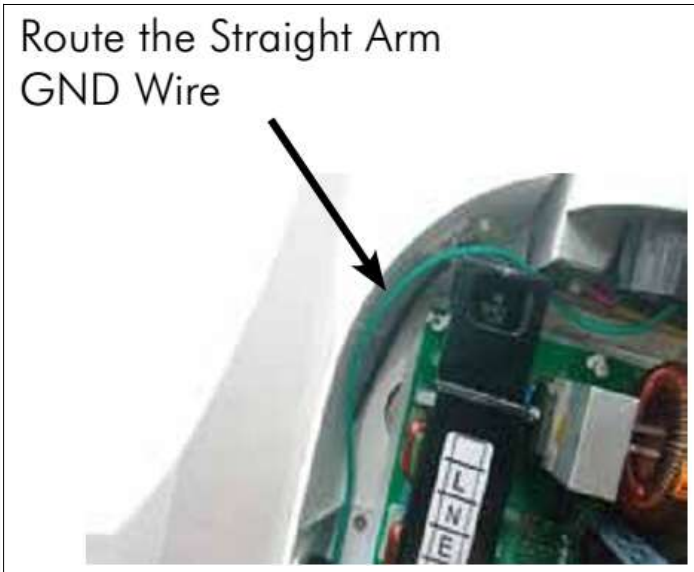


Figure 22 (A)

Figure 22 (B)

- Remove the end cap of the straight arm by removing 1no of M3x6 CSK screw using Phillips screw driver as shown in Figure 23.
- Remove the bottom caps of the straight arm by removing M3x6 CSK screws(2 no's for each cap) using Phillips screw driver as shown in Figure 24.

Figure 23: Remove end cap (M3x6 self tapping Counter sunk screws)Use screw driver

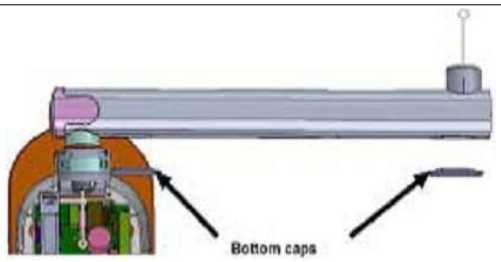


Figure 24: Remove bottom caps (M3x6 self tapping Counter sunk screws)Use screw driver

- Remove the M8 locking screw along with M8 spring washer and plain washer using 6mm Allen key as shown in Figure 25.
- Route the guide wire / Nylon Tube to the bottom side of the straight arm as shown in Figure 26.

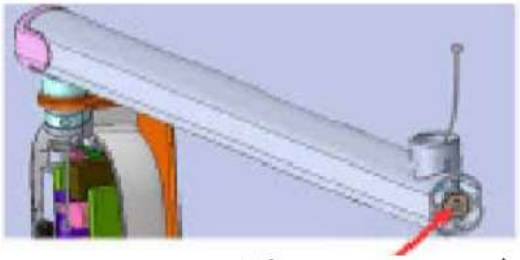


Figure 25

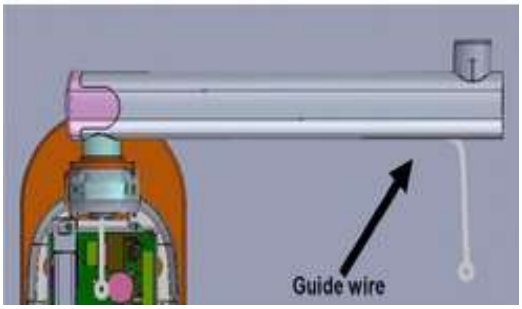


Figure 26

11.6 Scissor Arm Installation

- The scissor arm with tube head attached is shipped tied close. Remove the securing cable tie only when directed during installation. The scissor arm can spring open causing injury.
- Always make sure to hold both arms of the assembly simultaneously while lifting or moving the scissor arm.
- Take the scissor-arm and insert the cables into the straight arm as shown in Figure 27 .
- Fix scissor arm assembly on to the straight arm as shown in Figure 27.
- Rotate and position the Scissor-arm in line to the straight arm as shown in Figure 28.
- Fix the M8 locking screw along with M8 spring washer and M8 plain washer using 6mm Allen key as shown in Figure 28.
- Cut the cable tie holding the scissor-arm and open the scissor-arm.

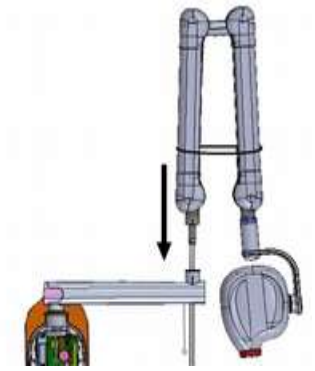


Figure 27

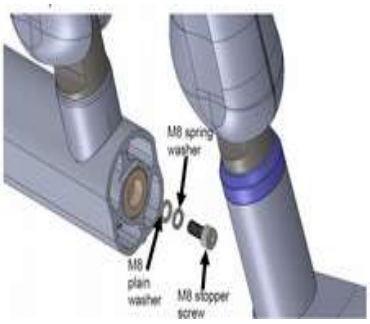


Figure 28

11.7 Scissor Arm Cables Connection

- Tie the end of the cables to the guide wire with magic twister as shown in Figure 29.
- Route the cable into straight arm till it comes inside the base unit by pulling the guide wire as shown in Figure 30.
- Remove the guide wire and magic twister after routing the cables into the base unit.

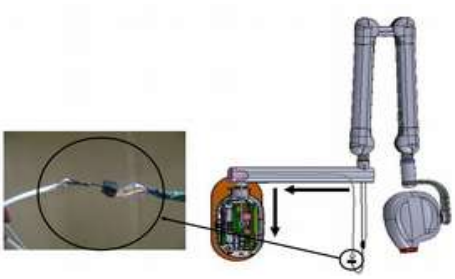


Figure 29

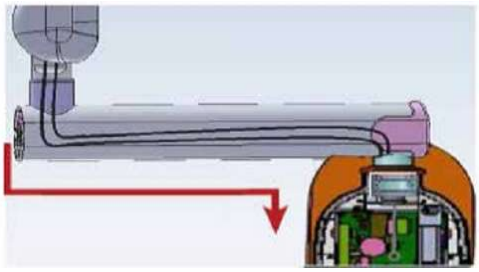


Figure 30

- Route the cables on the right side of the base unit as shown in Figure 31.
- Connect the communication cable connector coming from scissor-arm to the J2 connector on the power board as shown in Figure 31.
- Connect the wires of the inverter cable(Non-polarised) to the J1 connector using jewel screw driver as shown in Figure 31.
- Connect the GND wires at the screw location available at the right bottom screw and fix the cables on the cable mount which is available in base unit using cable ties as shown in Figure 31.

- Fix the M6 stopper screw to the straight arm shaft using 5mm Allen key as shown in Figure 32.

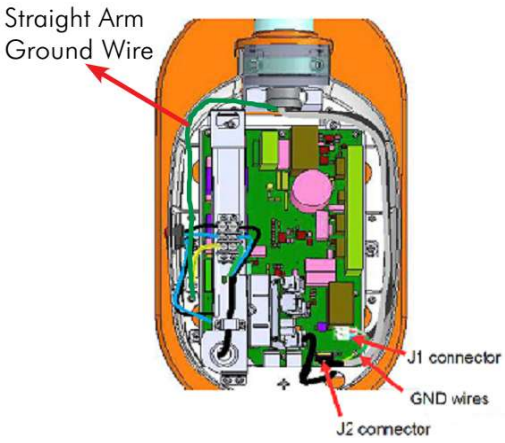


Figure 31

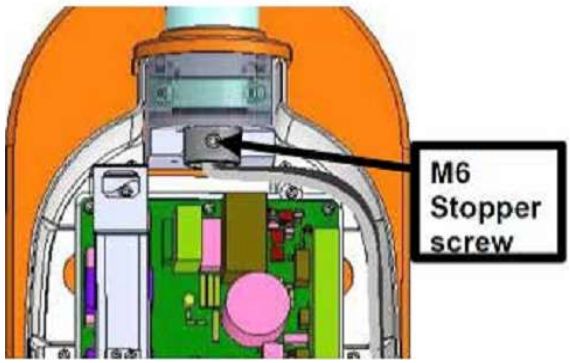


Figure 32

Lay cables flushed along the right inner side. Carefully pull any excess length and push the cables behind the power board.

- Fix the bottom caps of the straight arm by fixing M3x6 CSK screws(2 screws for each cap)by using star screw driver as shown in Figure 33.
- Fix the end cap of the straight arm by fixing M3x6 CSK screw using Star screw driver as shown in Figure 34.

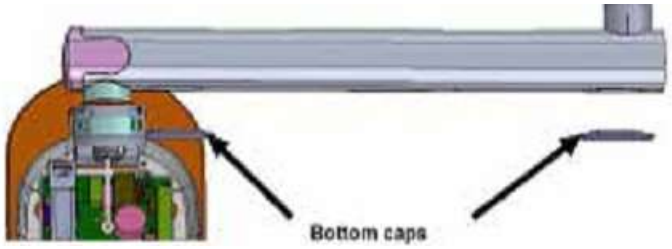
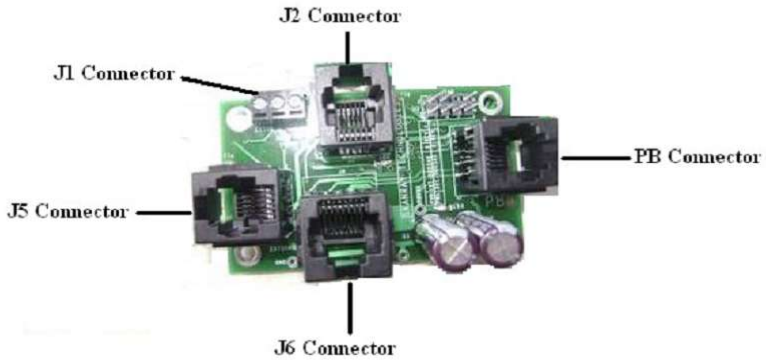


Figure 33

Figure 34 Fix end cap (M3x6 self tapping Counter sunk screws)Use screw driver



Connector Details of Extension Board

- Insert free end of Console cable through the hole provided on the bottom side of the "Base Unit Bottom cover" as shown in Figure 35.

- Console cable connection (free end) on J5 connector of Extension Board and tie the console cable on cable mount with cable tie as shown in Figure 35 (A).

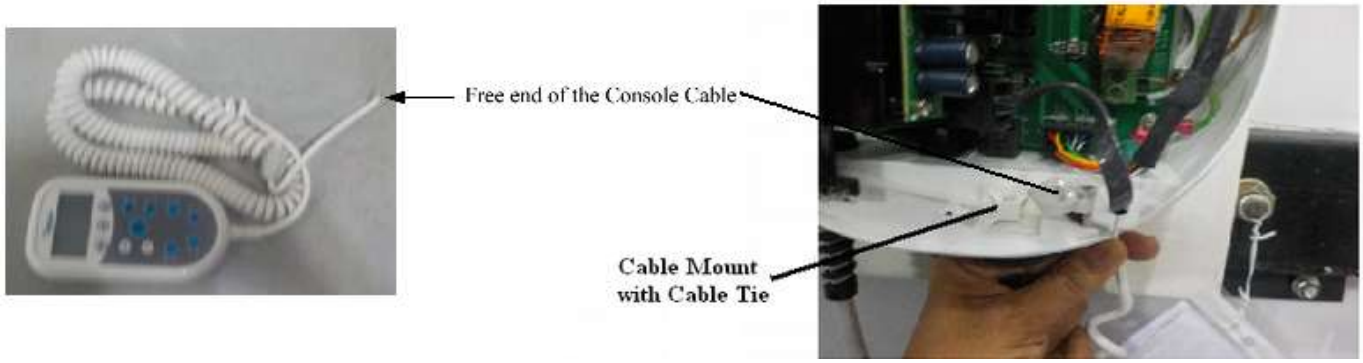


Figure 35

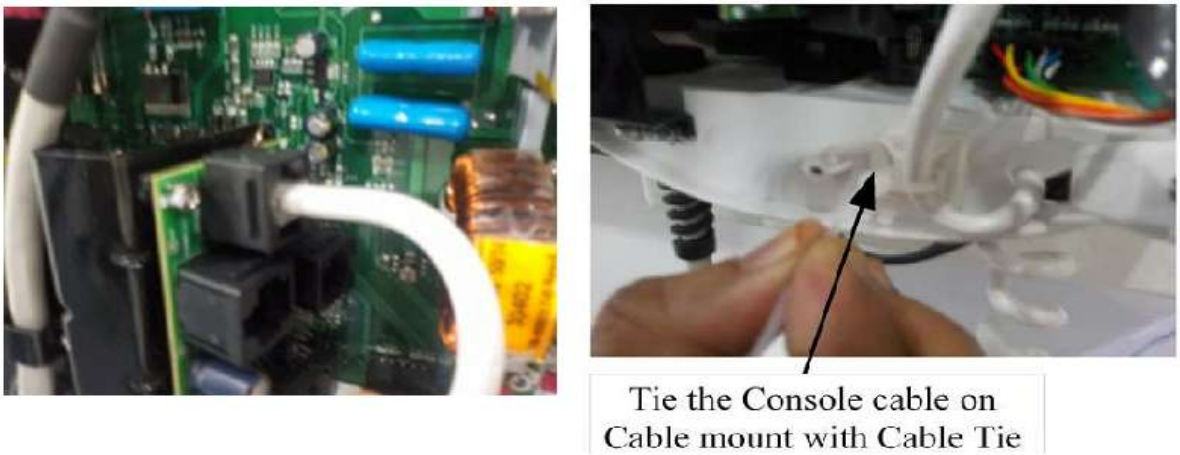


Figure 35 (A)

11.7.1 Remote Console & Door Bell Switch Installation(Optional)

Marking the drill locations:-

- Take the remote console template from packing box and fix it at the desired location on the stud.
- Confirm the level of the template using spirit level.
- Mark the locations for the 2 mounting holes on the template.
- Mark the location for the wiring hole on the template as shown in Figure- 35(B).
- Drill the 2 mounting holes marked using 5/32" drill bit to the depth of 1.26" and drill the direct wiring hole(>1.5" dia).
- Take the remote keypad console assembly. Pull out the console from the slot and remove 4 No's. M3x6 socket head screw with M3 plain washers using 2.5 mm allen key as shown in Figure- 35(C).
- Lift the cover along with console assembly and disconnect the console cable from the J8 connector of the board and keep the parts aside as shown in Figure- 35(D).
- Take the base plate of remote keypad console and route the remote console communication cable through the hole provided on the plate and fix the remote console plate on the stud with 2 No's of 6.3x32mm self tap wood screw using 8 mm box spanner at the 2 mounting hole locations as shown in Figure- 35(E).
- Follow the same steps for fixing the Door bell switch assembly as above if door bell switch is used.

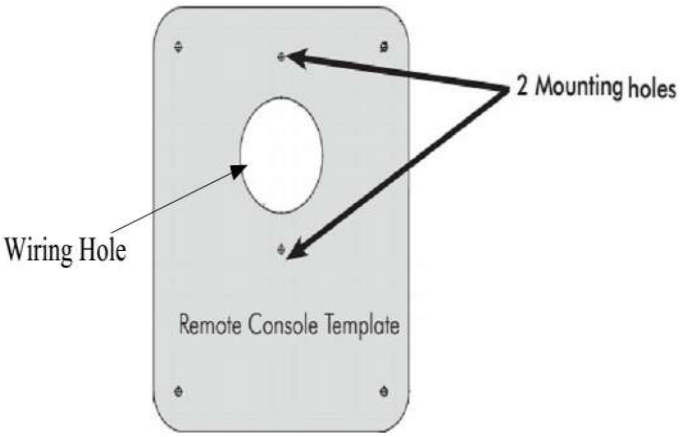


Figure- 35(B)

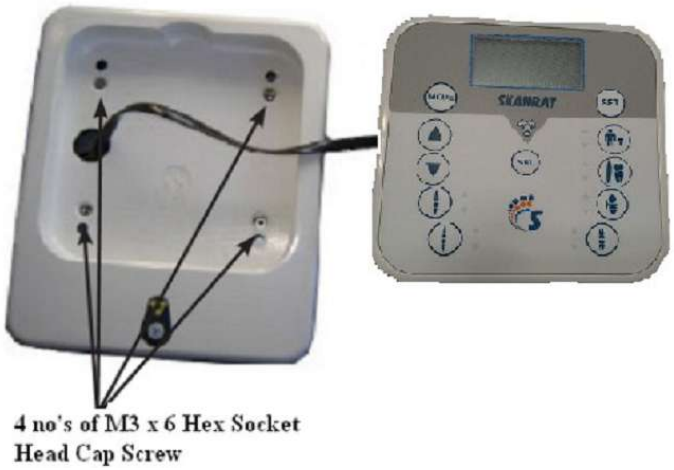


Figure- 35(C)

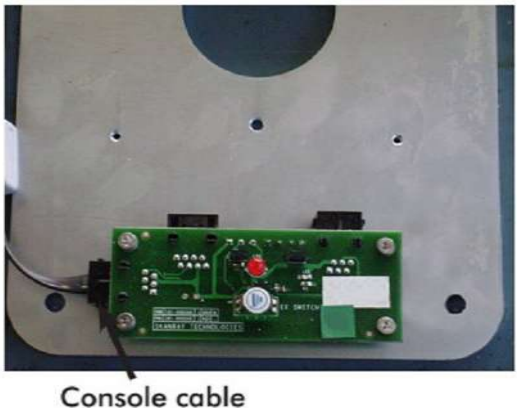


Figure- 35(D)

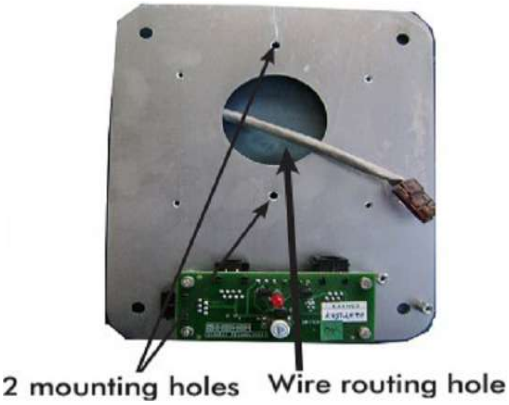


Figure- 35(E)

- Connect the external console cable to J8 connector as shown in Figure- 35(F).
- Close the cover of the remote console by fixing 4 No's. M3x6 socket head screw using 2.5 mm allen key and fix back the remote keypad console in the slot of the cover as shown in Figure- 35(G).

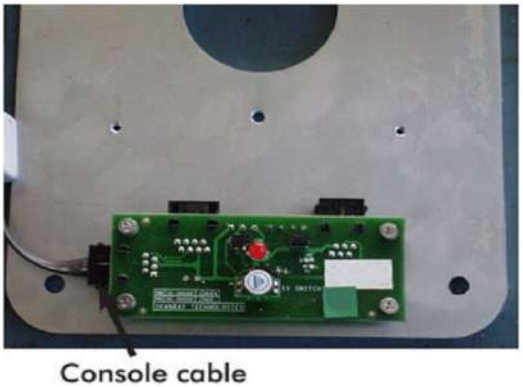
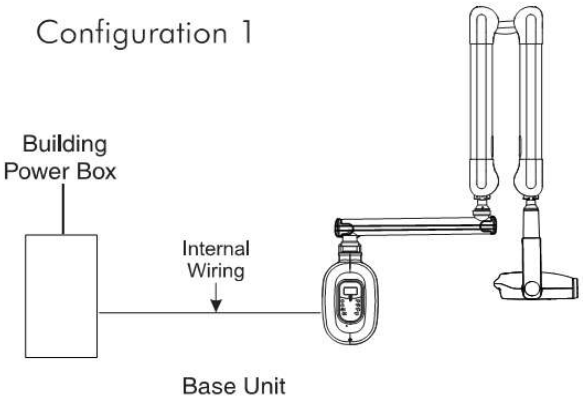


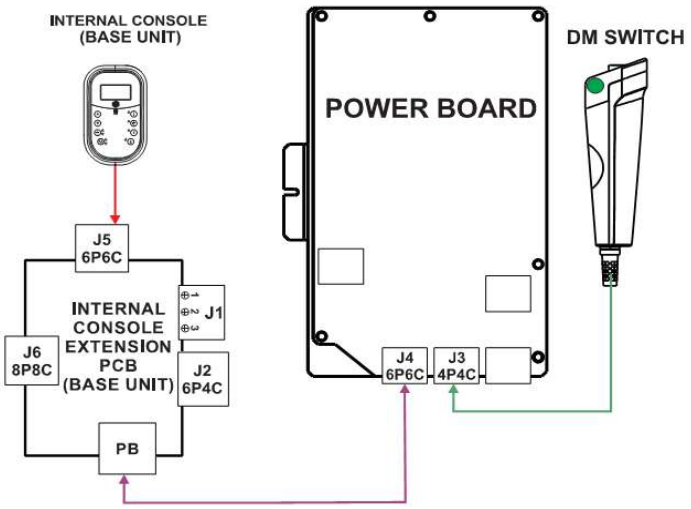
Figure- 35(F)

Figure- 35(G)

11.7.2 Remote Console & Door Bell Switch Wiring Configuration:-

Configuration 1

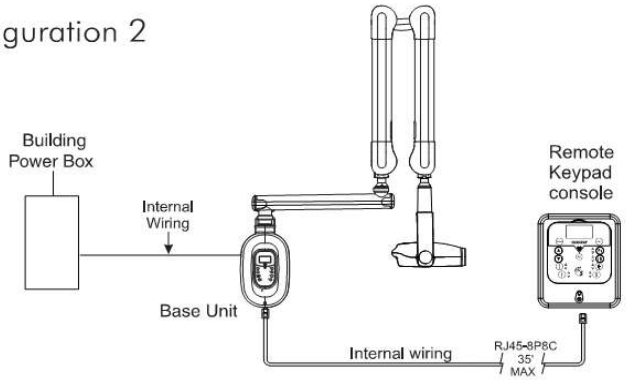




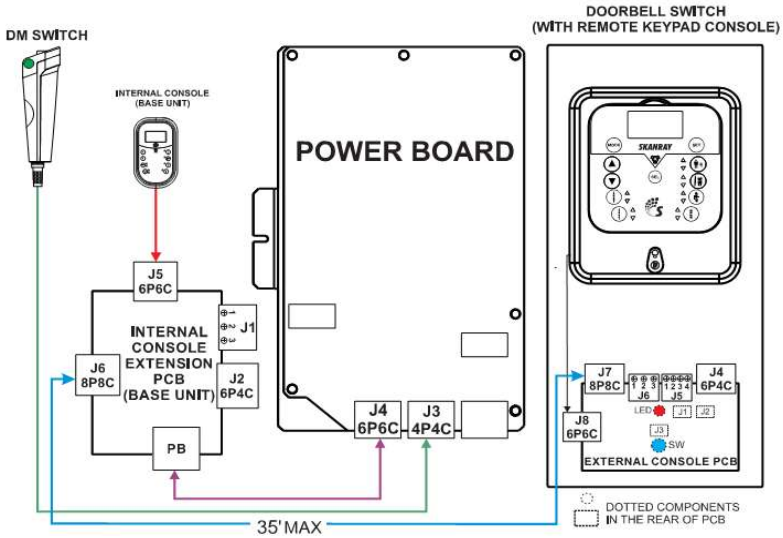
Common to Mobile and Wall mount Use Internal Console and Internal Exp Switch

Can use Internal Console and Internal Exposure Switch.

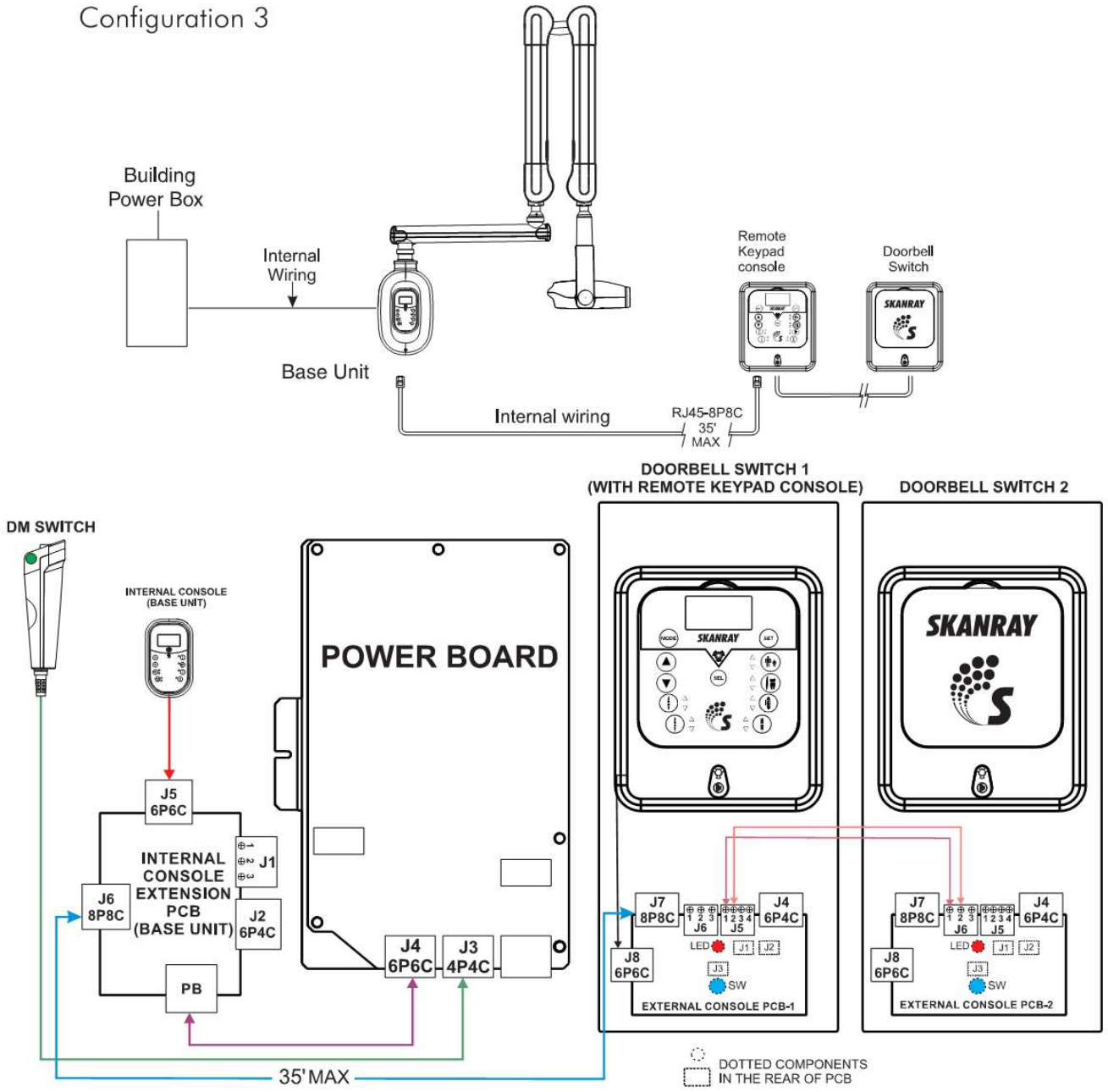
Configuration 2



- 8P8C with single door bell switch.
- Can use two Consoles with Internal Exposre Switch and single door bell switch.
- J3: Open and J1, J2:Short on external console PCB.

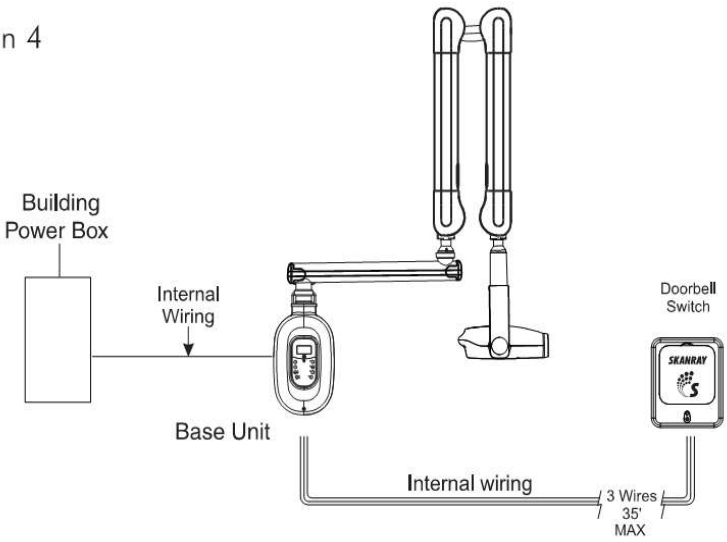


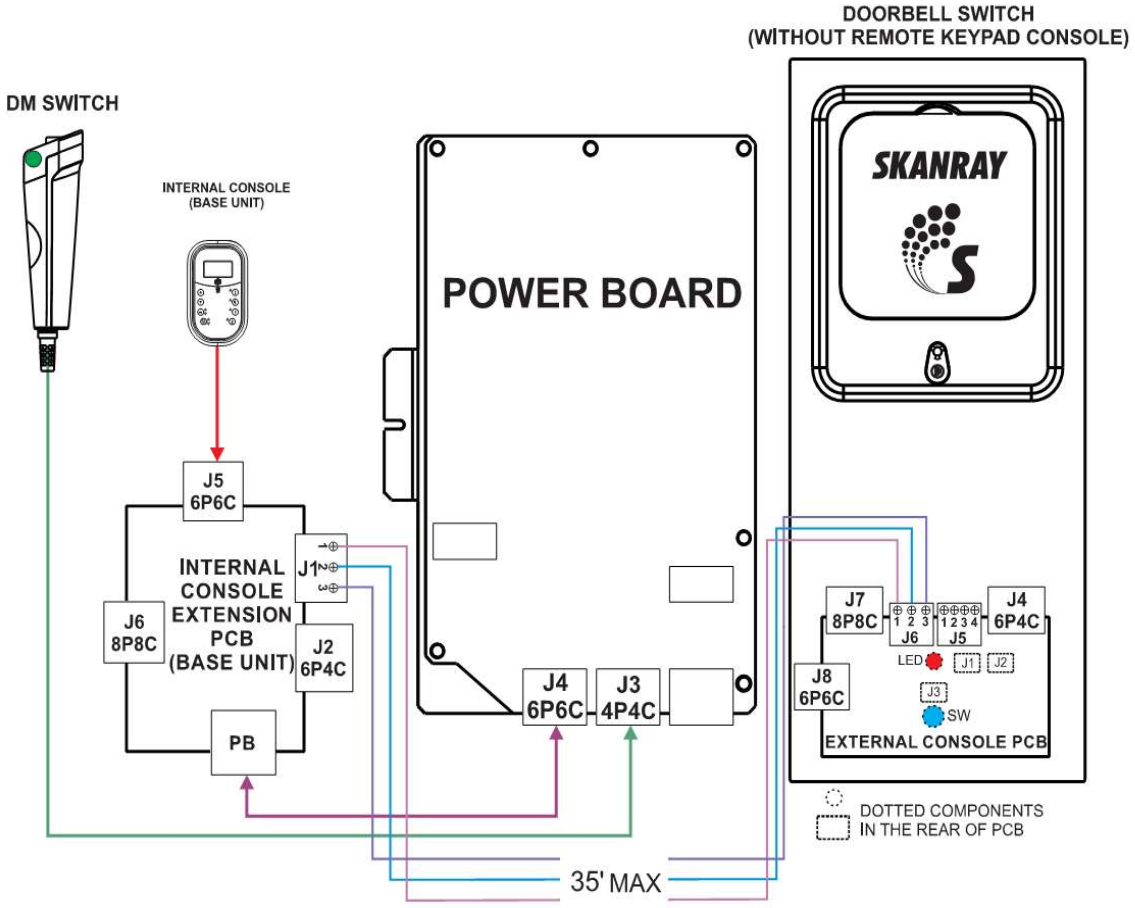
Configuration 3



- 8P8C with door bell switch.
- Can use two Consoles with Internal Exposure Switch and double door bell switch.
- J1,J3 Open, J2 Short on External console PCB-1.
- J1,J3 Open, J2 Short on External console PCB-2.

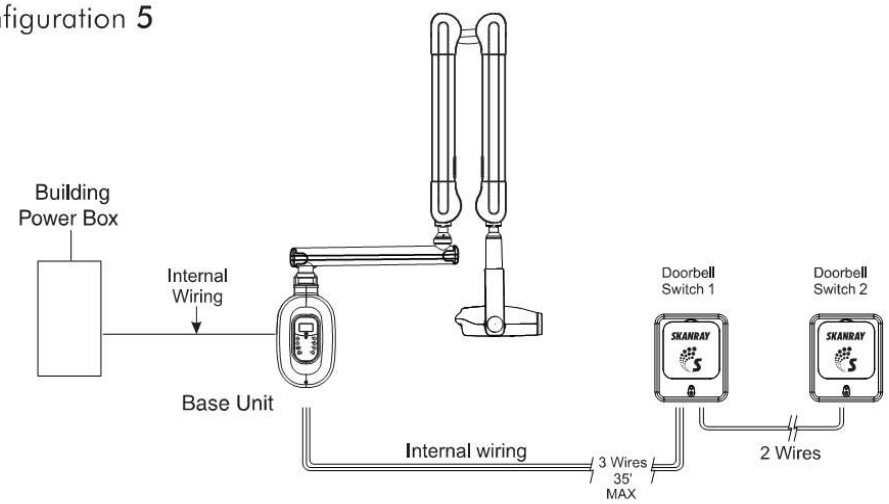
Configuration 4

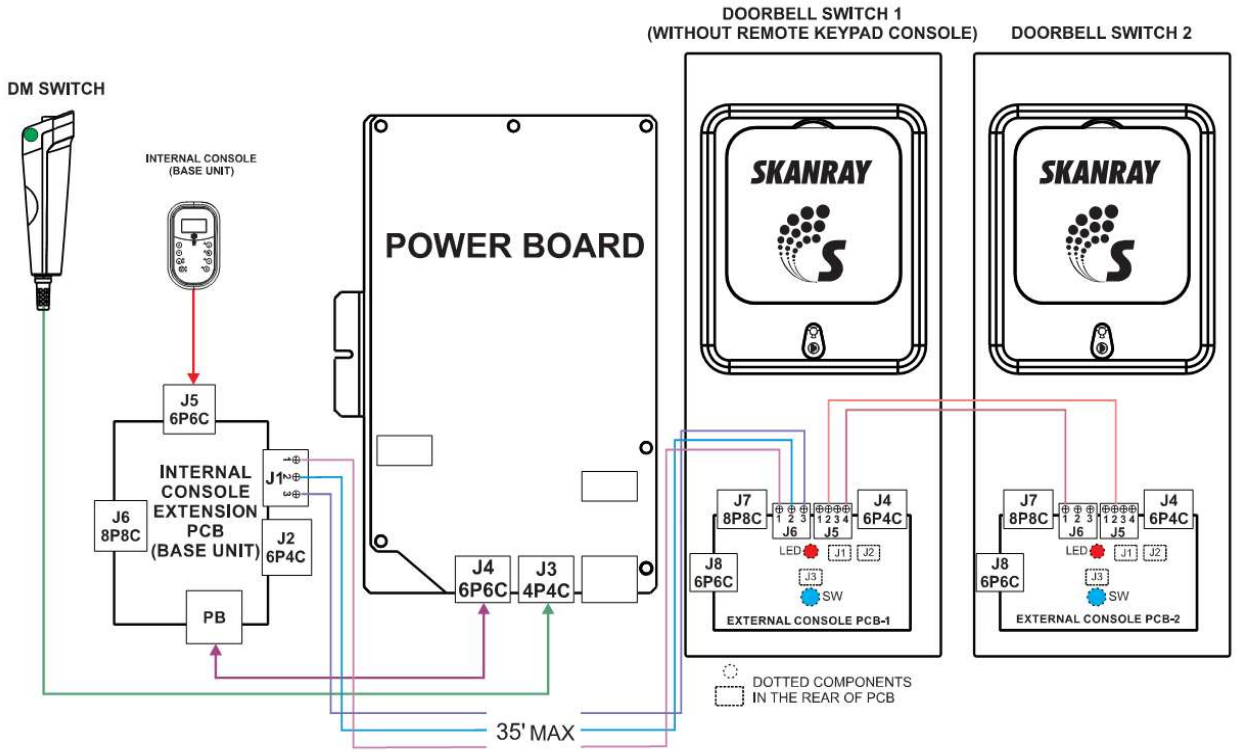




- 3 WIRE WITH SINGLE DOORBELL SWITCH.
- J1, J3 are open while J2 is shorted on External console PCB.
- Can use Internal Console with Internal Exposure Switch and single door bell switch.

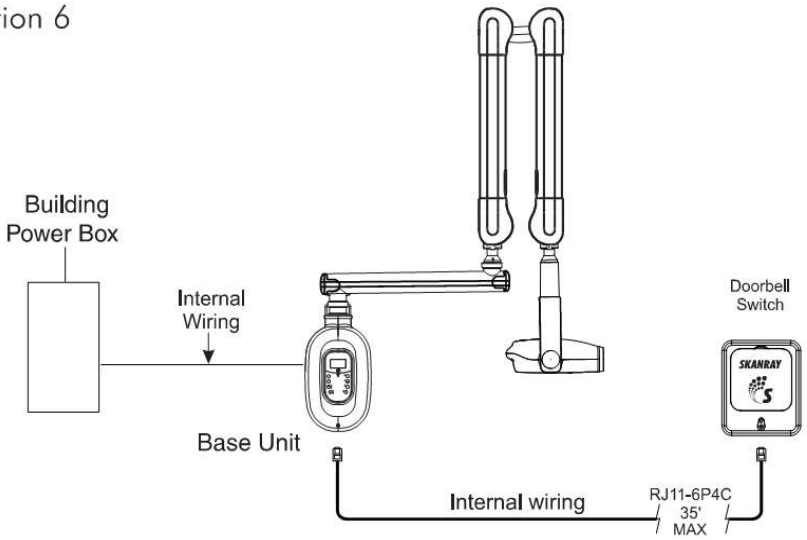
Configuration 5

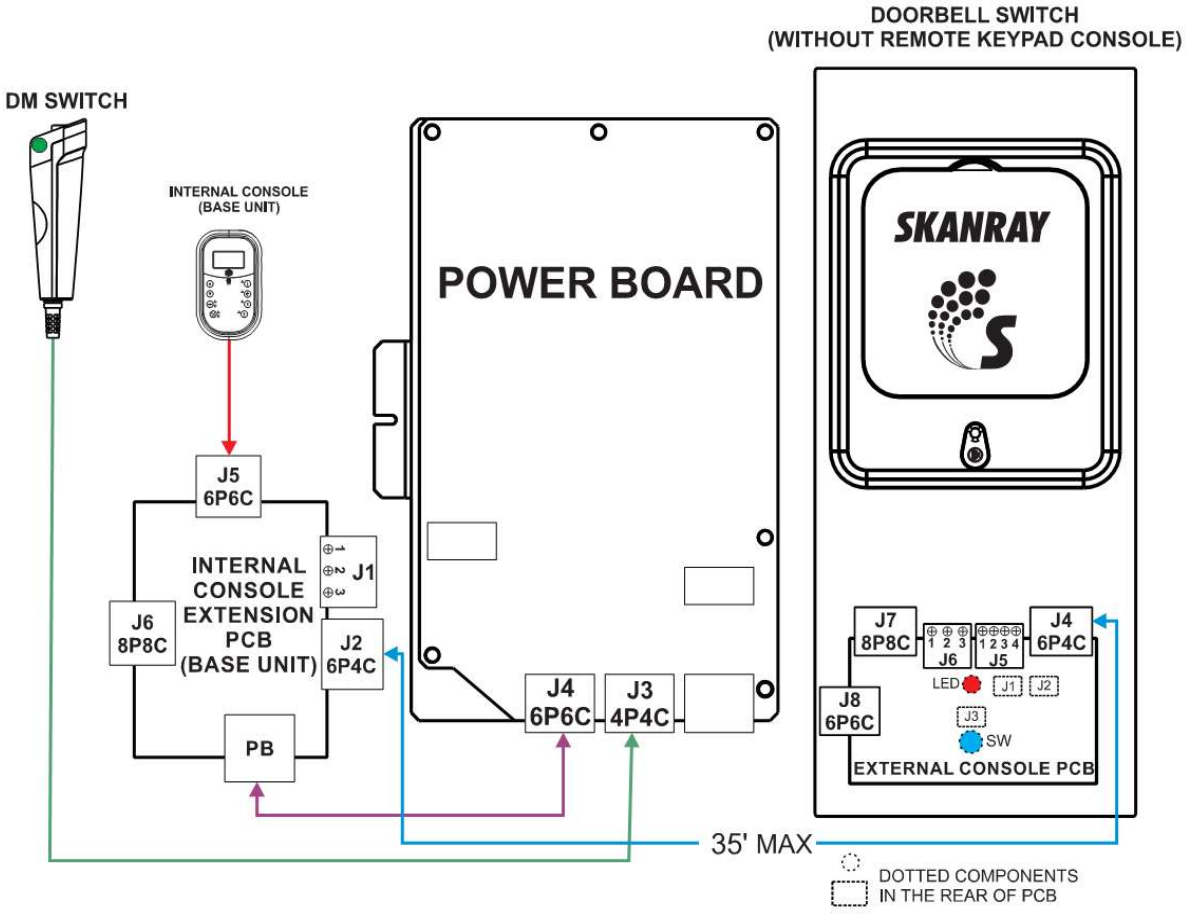




- 3 WIRE WITH DOUBLE DOORBELL SWITCH
- Can use Internal Console with Internal Exposure Switch and double door bell switch.
- J1,J2 and J3 Open on External console PCB-1.
- J1,J2 and J3 Open on External console PCB-2.

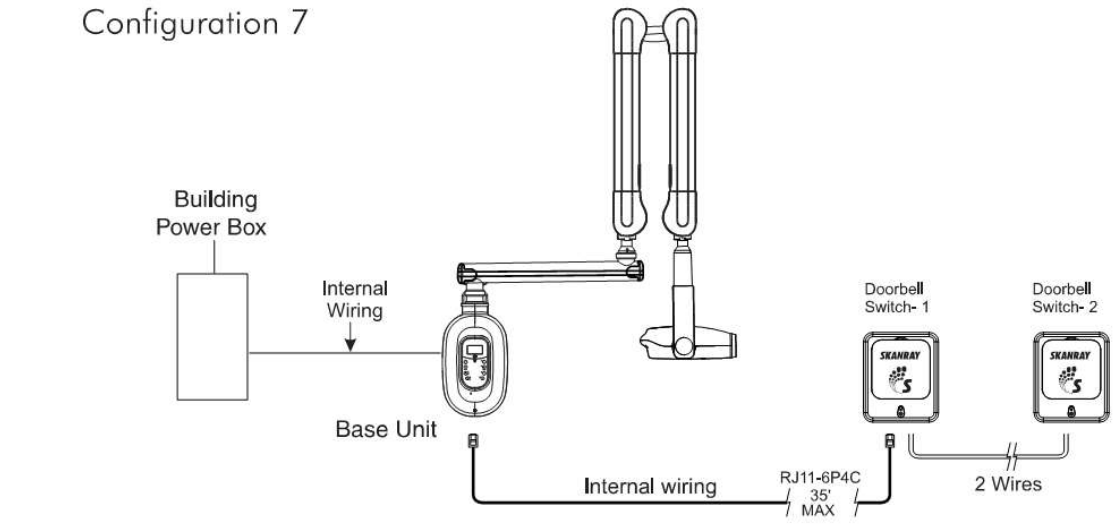
Configuration 6

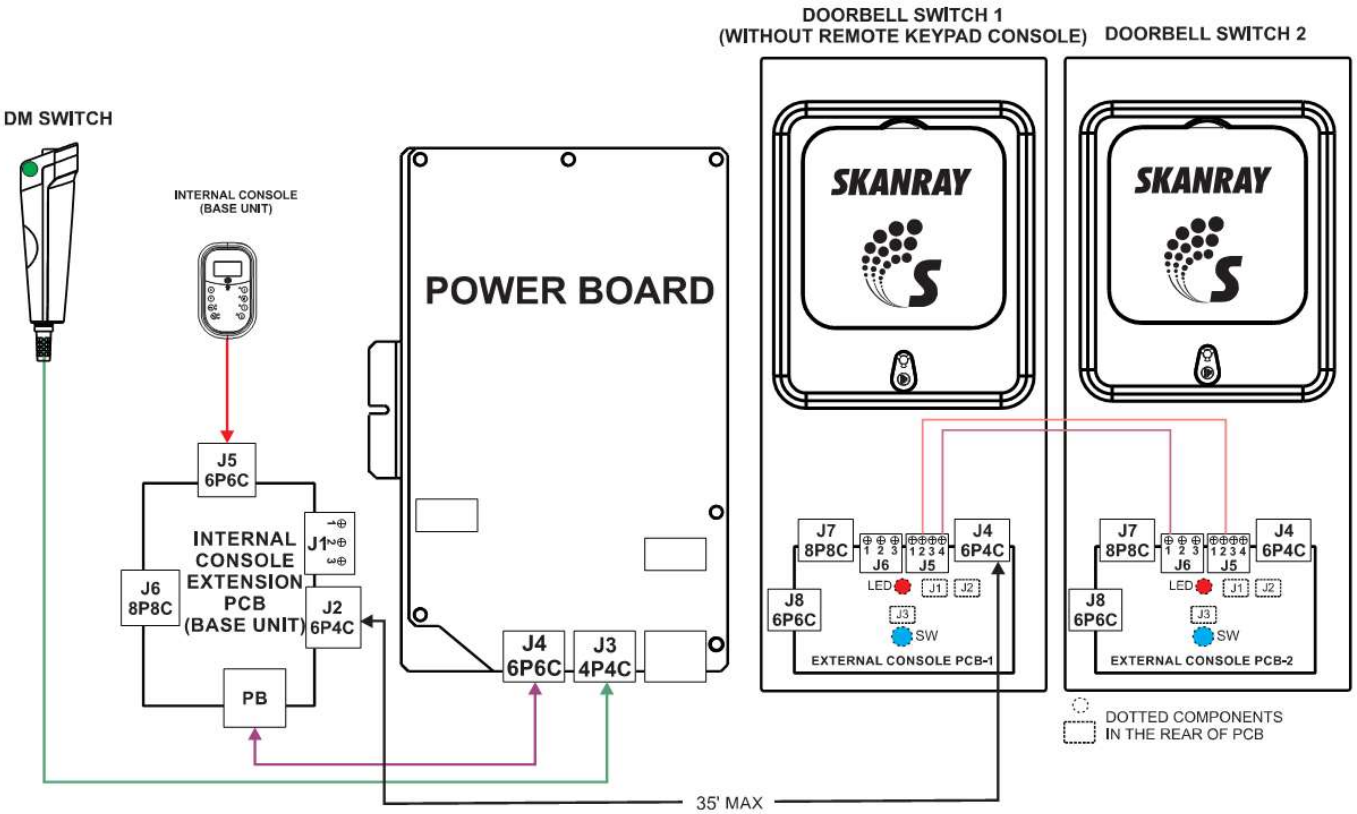




- 6P4C WITH SINGLE DOORBELL SWITCH.
- J1, J3 are open while J2 is shorted on External console extension PCB.
- Can use Internal Console with Internal Exposure Switch and single door bell switch.

Configuration 7





- 6P4C WITH DOUBLE DOORBELL SWITCH.
- Can use Internal Console with Internal Exposure Switch and double door bell switch.
- J1,J2 and J3 Open on External console extension PCB-1.
- J1,J2 and J3 Open on External console extension PCB-2.

11.7.3 Base Unit Cover Fixing

- Take base unit Front cover assembly,allign two drilled holes on the front cover top to the Set screw and Hang the cover over set screw as shown in Figure- 35(H)

Figure- 35(H)

- Fix Base unit front cover using KA30 x 25 Pan head PT screw at bottom side using Phillips Screw Driver and fix the rubber pulg at the screw location as shown in Figure 36.
- Take 2 no's of M3 Brass Insert and fix on to the Set screw by hand. (Ensure the Brass Insert knurled area should be on top for easy handling) as shown in Figure 37.

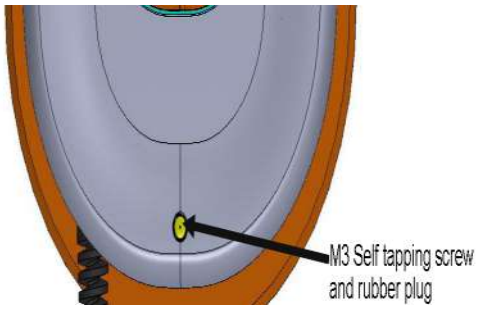


Figure 36

Figure 37

- Take Keypad console and place it in the console holder as shown in Figure- 37(A).
- Take Exposure Switch assembly and Insert the free end of Exposure Switch cable on J3 connector(Bottom side of the Base Unit Bottom cover) as shown in Figure- 37(B).

Figure 37(A)

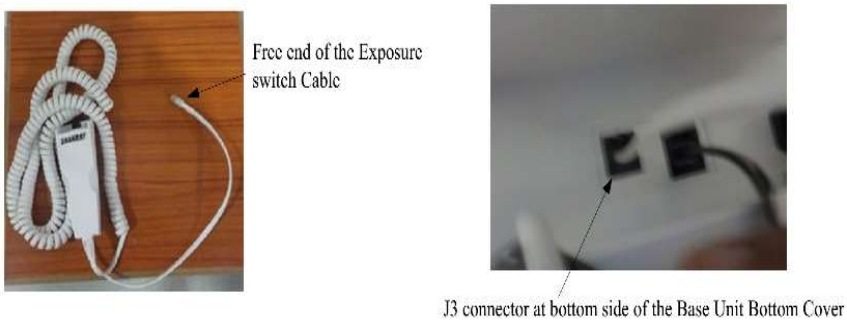


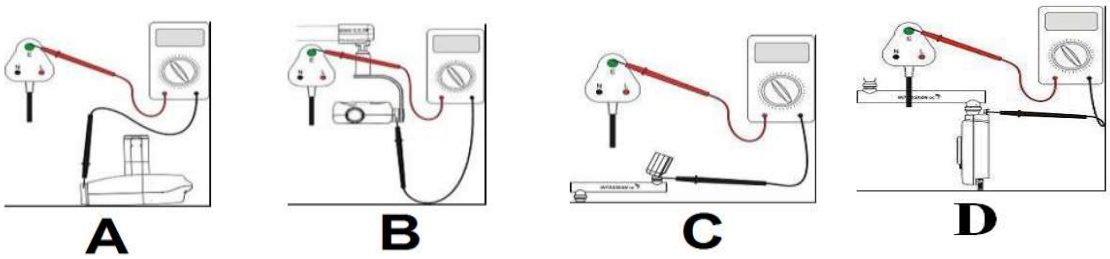
Figure 37(B)

11.8 Ground Check Connection

Using a Multimeter, check the continuity between the following points:-

A. Between Ground point of power plug and Tube Head inner Cone metal part,
B. Between Power Plug Earth pin and Tube Head L arm screw.
C. Between Ground point of power plug and Scissor Arm guide Rod.
D. Between Ground point of power plug and Base Unit Wall mounting plate.
If any of the check fails then check the Ground connections inside Base Unit & Tube Head for Cable fault.

Note : Check the continuity at the non painted location.



If any of the arm is drifting,

- First check the level of the straight arm using spirit level and if the level is fine.
- Remove the rectangular cap of the S arm and tighten the slotted nut as required to stop the drifting.
- If the slotted nut is over tighten the arm may reflect back once closed completely.

11.9 Scissor-Arm Operation Checking:

- Move the Scissor arm and ensure there is no drift as per steps given below.
- Keep the Vertical Arm in vertical position and horizontal arm in horizontal position.
- Move the horizontal arm down (folding movement) in small jerk free incremental steps of approximately 10 degrees.
- At each step as above, leave the scissor arm and ensure that there is no drift movement. Continue till the horizontal arm reaches vertical position.
- Keep the Vertical Arm in vertical position and horizontal arm in horizontal position.
- Pull the L Arm in small jerk free incremental steps of approximately 10° so that the horizontal arm stays horizontal always and the Vertical arm moves down.
- At each step as above, leave the scissor arm and ensure that there is no drift movement. Continue till the maximum expanded position of the scissor arm is reached.
- Keep the Scissor arm in folded position
- Refer “11.12 Mechanical Adjustment” in case of minor adjustment of scissor arm.

11.10 Other Checks

- Ensure the Straight-Arm rotation is 170-190° approximately from end to end of the Base Unit.
- Ensure that the Tube head rotation about the axis is 300-310° approximately.
- Ensure that the L arm rotation angle is 520-540° approximately.
- Ensure that the scissor-arm rotation about the straight-arm is 200-230° approximately.

11.11 Power On Check

For new Installation, if installation date is > 6months of mfg date of Tube Head, carry out procedure as mentioned in section" X-Ray Tube Seasoning".procedure as at the end of this document before proceeding. Keep the Power switch of the Unit in OFF position. Connect the Input Power Chord of the Unit to the wall Electrical Outlet (Not applicable for US Variants where wall direct wiring is used). Switch On the power in the base unit and using Console give following exposures.

For 0.8FS and 0.5FS Unit
70kV/8mA, 2 Sec Exposure 2 Times
60kV/4mA 40 ms Exposure 2 Times
In case of 0.4 FS unit
70kV/6mA, 2 Sec Exposure 2 Times
60kV/4mA 40 ms Exposure 2 Times
If no errors are reported, then the Unit is ready to use.

11.12 Mechanical Adjustments

- Before starting any mechanical adjustments ensure the power to the Unit is switched OFF.

Adjustment of Spring Tension of Scissor Arm

- Remove the rectangular caps from the spring adjusting windows of the Scissor Arm as shown in Figure 38 .
- Check the Straight-Arm level using sprit level. The Straight-Arm end should be at an angle of 1° gradient approximately above the base unit end as shown in Figure 39 . If the angle is less then check the Straight-Arm & the Base Unit for wear out.

Figure 38

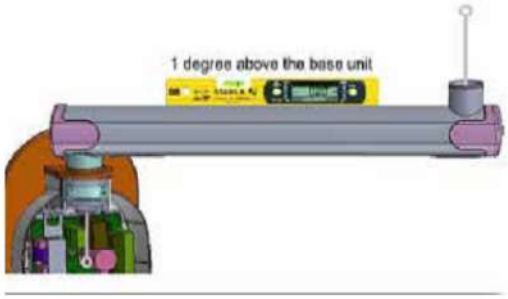


Figure 39

Step 1:-

- Keep vertical arm in vertical position and the horizontal arm in horizontal position as shown in the Figure 40 (illustration 2). The scissor arm should not droop from its position. If it droops, tighten the horizontal arm spring using Flat screw driver through the spring adjustment window (by tightening the slotted nut as shown in Figure 38).

Step 2:-

- Keep the scissor arm with both arms vertical position (folded position) as shown in the Figure 40 (illustration 1). The Scissor Arm should stay in its locked position without moving or drifting. If unstable, replace the Scissor Arm.
- Note: If over tightened, the effort required to move the horizontal arm is high in which case loosening may be required.

Step 3:-

- Keep the vertical arm in horizontal position and horizontal arm in vertical position as shown in the Figure 40 (illustration 3). Both the arms should stay in position without moving. In this position the horizontal arm is in locked position and no adjustments are required for the horizontal arm. If the vertical arm is unstable adjust the vertical arm spring by loosening (by loosening the slotted nut) using flat screw driver through the spring adjustment window as shown in Figure 38 .

Movement Check-1:

- Move the scissor arm very slowly in small increments from step 3 to step 2 position as above and then move back similarly from step 2 to step 3 position in small increments . The scissor arm should stay stable without drooping at all positions.
- If it droops, tighten the vertical arm spring using screwdriver through the spring adjustment window (by tightening the slotted nut as shown in Figure 38). Once it reaches Step 3 position, if the Vertical arm moves up (unstable) then adjust the vertical arm spring by loosening (by loosening the slotted nut as shown in Figure 45) using screwdriver through the spring adjustment window. Repeat the "Movement Check-1" procedure to reconfirm or fine tune adjustments.

Movement Check-2:

- Move the scissor arm very slowly in small increments from step 3 to fully expanded position as shown in illustration 4 of Figure 40.The scissor arm should stay stable at all positions. If unstable, Scissor Arm need to be replaced.

Movement Check-3:

- Move the vertical arm from 0° to 90° stopping at every 10° increment approximately. For every position move the horizontal arm from one extreme end to another extreme end stopping at every 10° increment. At each position the

scissor arm should be stable. If unstable, Scissor Arm need to be replaced. Fix the 2 rectangular S-ARM caps to the spring adjusting windows of the scissor arm.

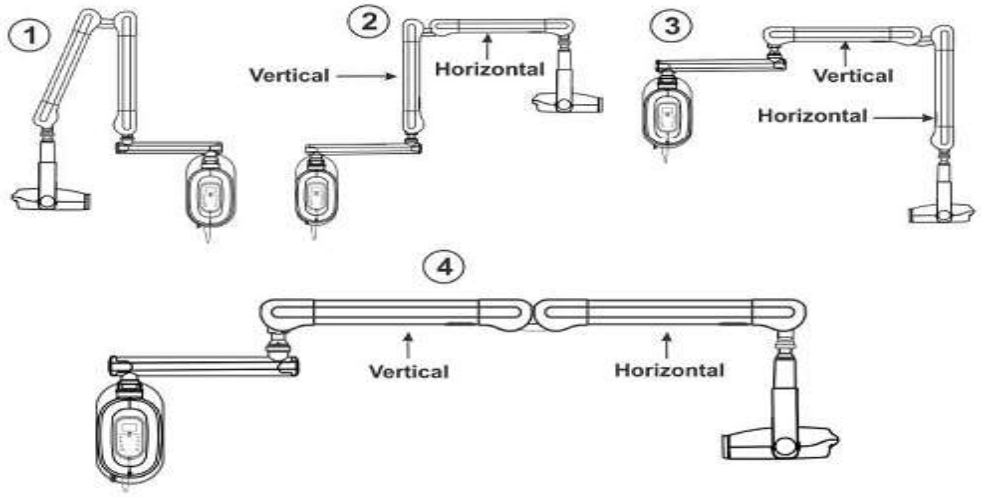


Figure 40

13 Troubleshooting of RAYOS DC

13.1 Errors and Warnings

When in a fault state, the unit would display an error message with a corresponding error code as defined here.

ERROR CODE	ERROR
CN001	Communication Error
CN002	Console & Tube head incompatible
CN003	X Ray Preparation (Prep) time out
CN004	Anode Arc Fault
CN005	Cathode Arc Fault
CN006	Over kV Fault
CN007	Over mA Fault
CN008	kV Regulation Fault
CN009	Filament Open Fault
CN010	Filament Limit Fault
CN011	CAN Fault
KB001	Key Jam Error

General Note: Power Recycling:-After switching OFF the Unit wait at least for 5 min before restarting the Power.

	OBSERVED PROBLEM	RECOMMENDED ACTION
1.	Error state with display indicating CN001	**Communication Error**: Recycle the power. Clean the contacts of the Console connector Spiral cord. Retry to give exposure. If the problem persists, replace the console, if problem persists, then check communication Cable continuity (try with external spare cable) and if still not resolved at the end replace Control Board. Once the Control board is replaced the Tube head has to undergo re-calibration.
2.	Error state with display indicating CN002	**Console & Tube head incompatible :** Recycle the power. Retry to give exposures. If the problem persists, replace the Console first & if problem still persists then replace control boards. If the Control board is replaced the Tube head has to undergo re-calibration.

	OBSERVED PROBLEM	RECOMMENDED ACTION
3	Error state with display indicating CN003	**Prep Time out :** Recycle the power. Retry to give the Exposure. If the problem Exists Replace the Control Board and if still problem persists, then replace Power Board. If the Control board is replaced the Tube head has to undergo re-calibration.
4	Error state with display indicating CN004	**Anode Arc Fault** : Recycle the power. Retry to give the Exposure. If the problem persists, Replace the tube Head.
5	Error state with display indicating CN005	**Cathode Arc Fault** : Recycle the power. Retry to give the Exposure. If the problem persists, Replace the tube Head.
6	Error state with display indicating CN006	**Over kV fault** : Recycle the power, retry to give the exposure. If the problem persists, check the communication cable & replace (try with external spare cable) , if problem persists then replace the Control board. If problem exists then replace the Tube Head. **Note** : If the Control board is replaced the Tube head has to undergo re-calibration.
7	Error state with display indicating CN007	**Over mA fault**: Recycle the power, retry to give the exposure. If the problem persists, Calibrate the tube head, If the problem Still persists, Replace tube Head.
8	Error state with display indicating CN008	**kV Regulation Fault :** Recycle the power. Retry to give the exposure. If the problem persists, check the continuity of the INV-power cable & replace (try with external spare cable), if problem persists then replace the Power board in the Base unit.
9	Error state with display indicating CN009	**Filament Open Fault** : Recycle the power. Retry to give the exposure, If the problem persists, Calibrate the tube head, If the problem still persists, replace tube Head.
10	Error state with display indicating CN010	**Filament Limit Fault :** Recycle the power. Retry to give the exposure, If the problem persists, Calibrate the tube head, If the problem still persists, replace tube Head.
11	Error state with display indicating CN011	CAN Fault: Recycle the power. Clean the contacts of the Console connector Spiral chord. Retry to give exposure. If the problem persists, replace the console, if problem persists, then check communication Cable continuity (try with external spare cable) and if still not resolved at the end replace Control Board. **Note** : Once the Control board is replaced the Tube head has to undergo re-calibration.
12	Error state with display indicating KB001	Ensure that none of the console keys depressed accidentally. Recycle the Power. If the problem persists replace the console.
13.	The unit does not power on when mains is switched on.	Remove the Base Unit Top cover. Check if neon pilot lamp is ON in the power board . If not, there may be a loose contact at the wall socket end or the wall outlet is not receiving power. Check local electrical circuit for trips. If neon lamp is ON then check the following. Ensure that the spiral cable connection to the base Unit is proper. Recycle the power. If problem persists then replace the Console. If the problem still persists replace the power Board.
14.	No x-ray image even though the unit indicates normal exposure	Ensure that the feedback values are correct in the Console. If OK then check the Image receptor used.

	OBSERVED PROBLEM	RECOMMENDED ACTION
1.	Scissor Arm is Drifting from its released position / does not stay in set position	Adjust the spring tension as described in " 11.12 Mechanical Adjustments". If still drift problem exists then replace the Scissor arm.

	OBSERVED PROBLEM	RECOMMENDED ACTION
2.	Scissor Arm Movement is Tight	Replace the Scissor Arm/Single Arm
3	Noise during Scissor arm movement	Remove the rectangular rubber caps of the Scissor arm at both ends and apply grease to the springs. If still problem persists then replace the scissor arm
4	Support Tube Movement is tight	Remove the Support Tube and put back after applying grease to all rotating parts. If still problem persists then replace the defective part.
5	Tube Head movement is loose	Remove the rubber cap on the Tube Head L Arm and check the screw tightening. You can try to slightly tighten the screw in case they are loose. Later put back the rubber cap. If the problem still exists then replace the Scissor arm/Single Arm.
6	Plastic or Rubber Parts damaged	Replace the damaged parts as per the FRU list
7	Oil leaking from the Tube Head	Replace the Tube Head

Tube Head Re-Calibration

- X-Ray tube head requires recalibration in the event of over mA, Filament open and filament limit faults.
- Switch OFF the Unit. Wait till the Console is OFF. Cover X-Ray out let by lead cap.
- Switch ON the power again. Using the Console press the Keys in the Sequence (from 1 to 8 continuously) as shown in Figure 41 below.
- Once Console is ready for calibration (i.e., display of console changes showing "**Calibrate"** in highlighted), insert the Dead man Switch connector jig shown in Figure 43, Figure 44 and Figure 45 at the bottom of the base unit then give calibration command (by pressing key 9 as shown in Figure 41).
- The Console will give long beep during the Calibration and it will take about 15 minutes to complete calibration. At the End of the calibration console will Display as "Done Please Restart". Switch OFF the Unit. Wait till the Console is OFF. **Remove the Dead Man Switch Connector Jig which is connected at the bottom of the Base Unit (Non-removal will cause Error during operation).**
- Switch ON the power again. Give trial exposures & check functioning. Now the Tube head is re-calibrated and ready to use.

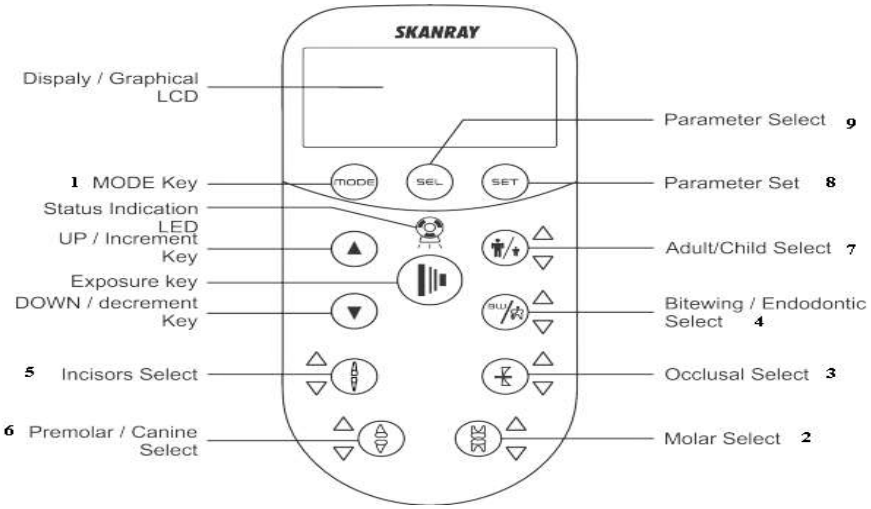


Figure 41

Figure 42

Figure 43

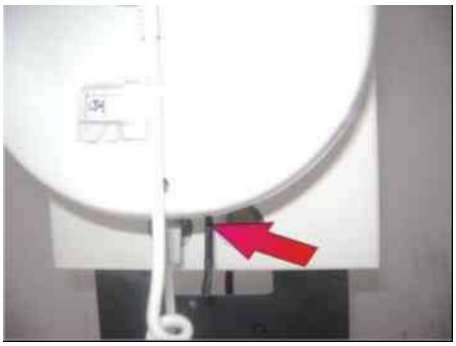


Figure 44

X-Ray Tube Seasoning

- In case of non-usage for long period (>6months) X Ray Tube Seasoning is recommended.
- Cover the Cone with Lead cup. Using the Control Console set the parameters as per table below.
- Give Exposure and repeat exposure 5 times for each combination of kV, mA and ms.
- After all the exposures are completed, the Unit is ready for use.

For 0.4 FS		
kV	mA	Time (ms)
60	4	40
60	6	40
60	8	40
60	4	500
60	6	500
60	8	500
65	4	40
65	6	40
65	8	40
65	4	500
65	6	500
65	8	200
70	4	40
70	6	40
70	8	40
70	4	500
70	6	500
70	8	200

0.4 FS unit

70kV/6mA, 2 Sec Exposure 2 Times
60kV/4mA 40 ms Exposure 2 Times
If no errors are reported, then the Unit is ready to use.

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RAYOS DC INSTALLATION MANUAL