

Servicevision Bis S.L.

Scorpio Light Series 10'/17'/23'L

User's manual v1.04



**SERVICE
VISION**


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1 TECHNICAL INFORMATION

1.1 BASIC INFORMATION

Servicevision provides a completely new concept of telescopic arms to the film and television industry. The Scorpio light series cranes had been designed to be the swiss army knife of the camera support equipment. Bringing a new whole and never-ending full range of possibilities and solutions on the remote camera support.

Another revolutionary feature of the light series is the possibility of displaying whole movement manually. In manual mode, the director, the photographer, or camera operator will manually perform the pan, tilt, and telescopic movement of the crane while the arm remains balanced, and the head levelled to horizon.... as said, a new whole world of possibilities.

The Electronic box to control the crane is extra small and light comparing to the heavy-duty series. With a removable touch panel display, it keeps all the functions and features developed by Scorpio for its bigger brothers. The arc compensator, operational limits, selectable speeds, memorization and, of course, interfaceable with the Scorpio heads to perform back pan and targeting functions.

SCORPIO 10'

THE UNIQUE ALL TERRAIN PORTABLE TELESCOPIC ARM IN THE MARKET.

Mitchel mounted in its Fulcrum; the arm it is compatible with any dolly in the market. Very compact when retracted and light to make it very easy to move and maneuver when accessing to difficult and small locations. A main tube plus two telescopic sections give 2.3 mts of telescopic travelling. With a 60kg payload capacity the Scorpio 10' is robust providing a solid and smooth continuous camera movement.

The Scorpio 10' can be provided together Scorpio Dolly. As robust and light as the arm, designed to be the perfect carrier for either the Scorpio 10, the Scorpio 17' and Scorpio 23'L. The articulable arms give the capacity of changing its width in three different positions: for 0.62mts standard dolly tracks, for 0.41mts tracks, and the last and narrowest configuration of only 0.65 total width, to make this telescopic arm + dolly accessible almost anywhere (*this smallest configuration is not for operational mode*).

Another key component is the telescopic column provided with the Scorpio Dolly. One single telescopic section, both manually or drill operated and as well as the Scorpio Dolly, the column has been designed to operate either the Scorpio 10', 17' and 23'L arms. Rise the column and reach the maximum tilt angle and optical height or low down the column and you will be able to get through any doorway higher than 173cm.

The Scorpio Dolly and the column are optional accessories when purchasing the Scorpio 10' and included when purchasing the Scorpio 17' or 23'L.

SCORPIO 17'

THE MIDDLE RANGE LIGHT COMPACT TELESCOPIC CRANE...

Mitchell mounted Fulcrum and with a main arm section with 3 telescopic sections, instead of 2, It keeps the advantages and characteristics of the Scorpio 10' but reaching a longer range of 4.05mts and keeping it in the light and compact crane concept, not affecting the portability and mobility. Using the very same Scorpio dolly as the Scorpio 10' warranties flexibility and accessibility to any location.

As well as the Scorpio 10 and Scorpio 23'L, the 17' belongs to the light line of cranes for Scorpio, where the arm can be removed very easy and quick, without the need of lifting or towing machine, only between 2- and 4-men operation can remove, assemble, and transport any of the arms (10', 17' and 23'L). The Michell mounted fulcrum allows to mount it in any Mitchell mount support and all the light series cranes range (*Scorpio 10, 17 and 23'L*) it gives the possibility of splitting the system in three separate operational parts, arm and fulcrum, the dolly and the column.

With the same payload capacity (60kgs.), it is the good match to be used in a vehicle, it is also a versatile small telescopic crane for any shooting situations such as stages, studios, small locations... a good solution for any job.

SCORPIO 23'L

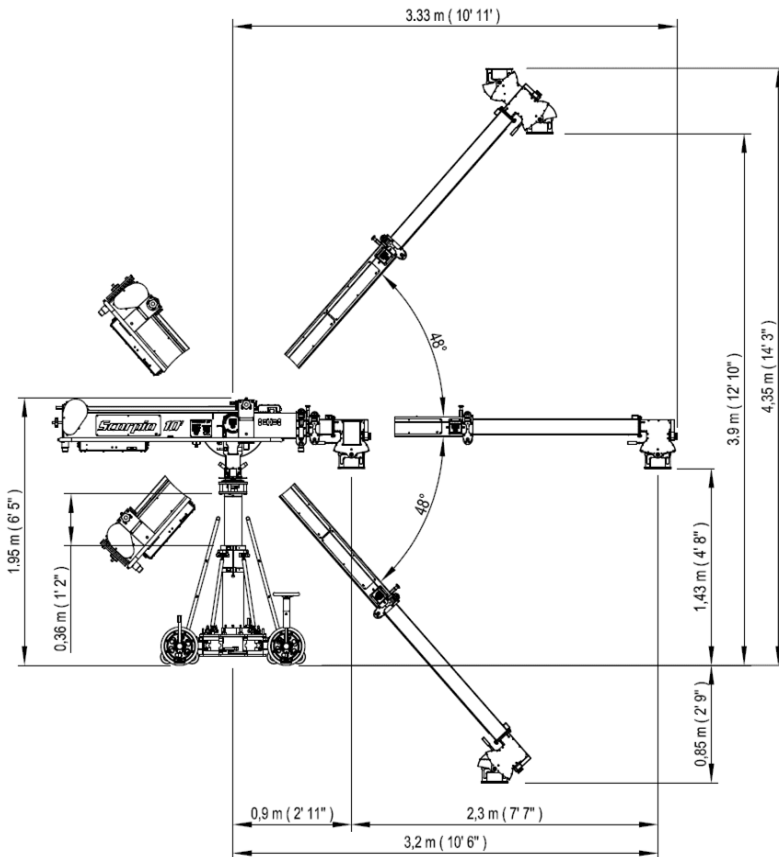
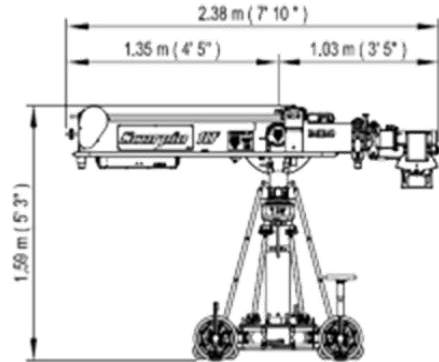
THE LONGEST RANGE WITH THE LIGHTEST WEIGHT...

This crane is designed to reach up to 5.6meters of telescopic range for a little bit less of payload capacity. The 40kgs payload warranties the capacity of taking any two axis or small stabilized remote head in the market with it and be able to reach 23 feet with a very light arm. Following the concept of the light series, the 23'L crane is also Mitchel mounted fulcrum and it consist in a main tube with 3 telescopic sections, like the Scorpio17 and keeping the concept of compatibility, maneuverability and portability of these light series.

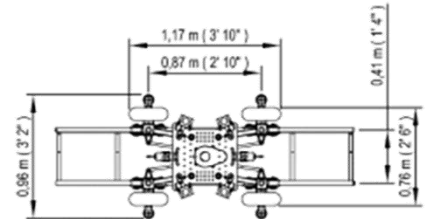
In comparison to the regular Scorpio23', this crane has the same length but much lighter and maneuverable. Mounted in the Scorpio Dolly gives this extra plus in maneuverability and accessibility to small or difficult access locations. And because is mounted in the same telescopic column allows to get a 23' telescopic crane fully mounted and loaded through any doorway.

1.2 SCORPIO 10' TECHNICAL SPECIFICATIONS

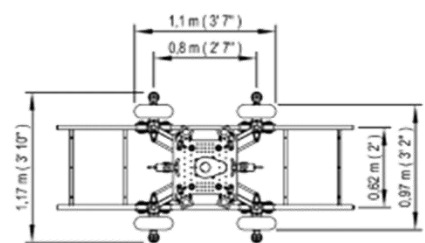
Max. length:	3,33m (10' 11")
Min. length:	1,03m (3' 5")
Back length of the arm:	1,35m (4' 5")
Telescopic Range:	2,30m (7' 7")
Max. height:	4,35m (14' 3")
Telescopic column range:	0,36m (1' 2")
Payload in Underslung:	60kg (132lbs)
Payload in Over slung:	40kg (88lbs)
Power requirements:	DC 30 v/ 40 A (for max speed, max payload; 20A for normal operation)
Output power for monitor:	DC 12 v/ 3 A
Speed of the arm:	1,3 m/s
Weight of the crane empty:	273,4kg. (602.7 lbs.)
Max. Weight when loaded:	544,6kg. (1200.6 lbs.)
Weight of the arm (empty):	68kg. (149.9lbs.)
Weight of the dolly, column & fulcrum:	162kg. (357.2lbs.)



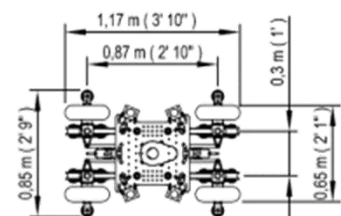
0,41 m (1' 4") TRACKS



0,62 m (2') TRACKS

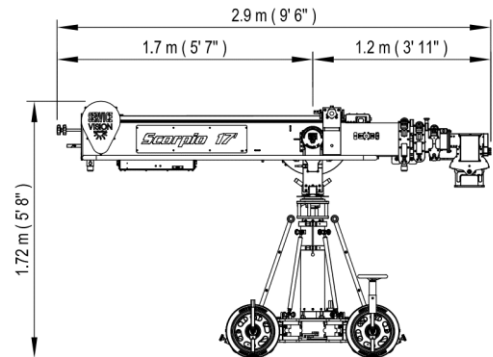


SMALLEST CONFIGURATION
(FOR TRANSPORT ONLY)

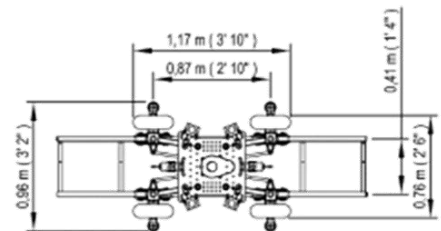


1.3 SCORPIO 17' TECHNICAL SPECIFICATIONS

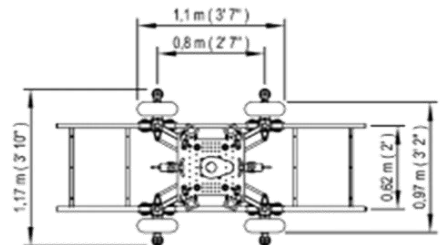
Max. length:	5,3m (17'5")
Min. length:	1,2m (3'11")
Back length of the arm:	1,7m (5'7")
Telescopic Range:	4,05m (13'3")
Max. height:	5,85m (19'2")
Telescopic column range:	0,36m (1'2")
Payload in Underslung:	60kg (132lbs)
Payload in Over slung:	40kg (88lbs)
Power requirements:	DC 30 v/ 40 A (for max speed, max payload; 20A for normal operation)
Output power for monitor:	DC 12 v/ 3 A
Speed of the arm:	1,5 m/s
Weight of the crane empty:	338,4kg. (746 lbs.)
Max. Weight when loaded:	744,3kg. (1641 lbs.)
Weight of the arm (empty):	122kg. (268.9lbs.)
Weight of the dolly, column & fulcrum:	166.1kg. (366.2lbs.)



0,41 m (1' 4") TRACKS

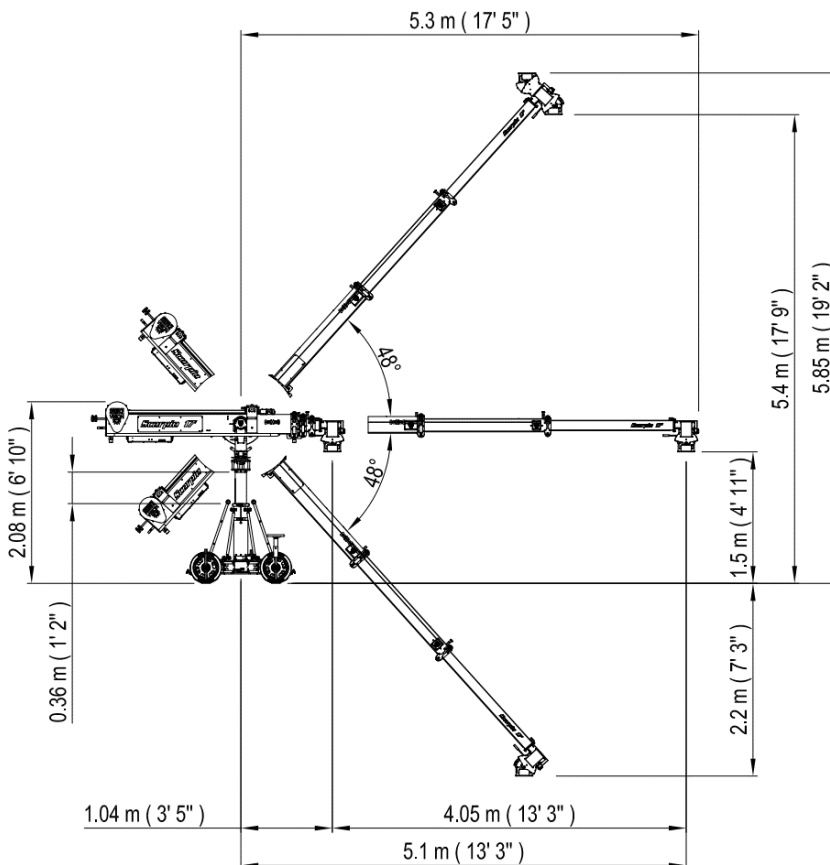
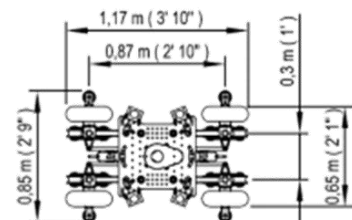


0,62 m (2') TRACKS



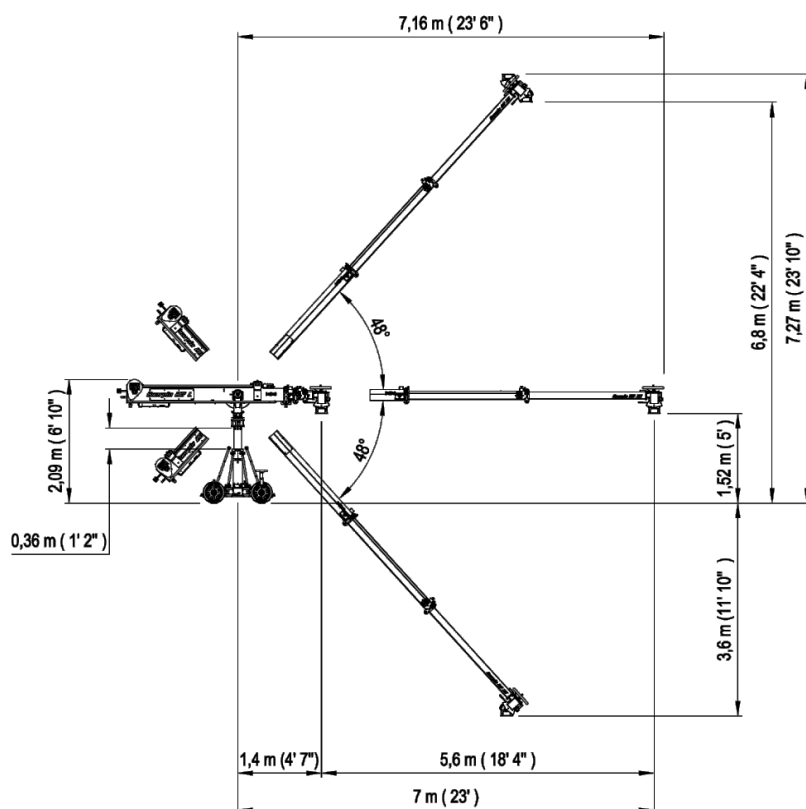
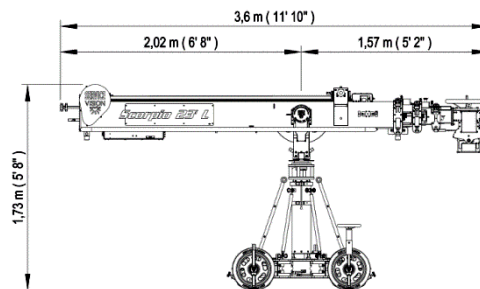
SMALLEST CONFIGURATION

(FOR TRANSPORT ONLY)

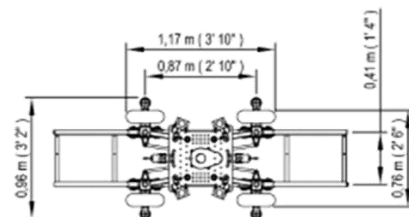


1.4 SCORPIO 23'L TECHNICAL SPECIFICATIONS

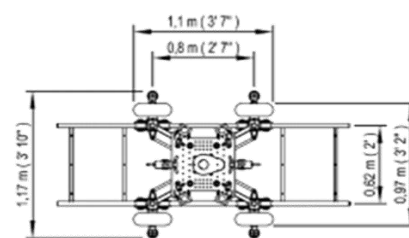
Max. length:	7.16 m (23'6")
Min. length:	1.57m (5'2")
Back length of the arm:	2.02m (6'8")
Telescopic Range:	5.6m (18'4")
Max. height:	7.27m (23'10")
Telescopic column range:	0,36m (1'2")
Payload in Underslung:	40kg (88lbs.)
Payload in Over slung:	40kg (88lbs.)
Power requirements:	DC 30 v/ 40 A (for max speed, max payload; 20 A for normal operation)
Output power for monitor:	DC 12 v/ 3 A
Speed of the arm:	1,7 m/s
Weight of the crane empty:	369,4 Kg. (814,4 lb.)
Max. Weight when loaded:	752,8 Kg. (1660lb.)
Weight of the arm (empty):	150kg. (330.7lbs.)
Weight of the dolly, column & fulcrum:	166.1kg. (366.2lbs.)



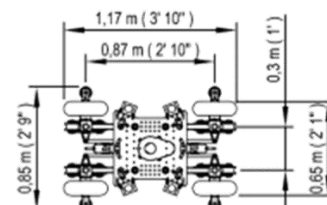
0,41 m (1' 4") TRACKS



0,62 m (2') TRACKS

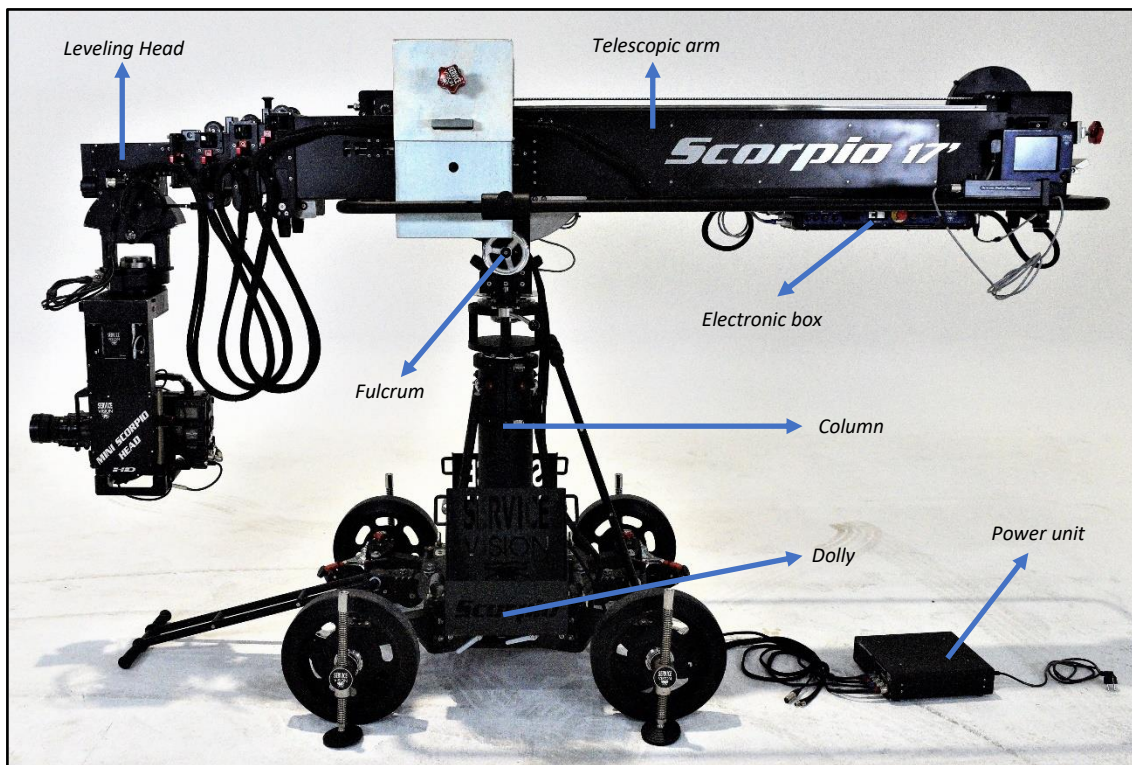


SMALLEST CONFIGURATION
(FOR TRANSPORT ONLY)



2 PARTS AND COMPONENTS DESCRIPTION

This is a general view of the general components on the telescopic light cranes:



2.01 Parts of the crane.

The dolly is the part that locates the crane in the position where it will be operated, either with the travelling wheels or the dolly wheels. The removable column gives the possibility to mount any standard Mitchell mount remote head in the base.

The column holds the arm and can be extended or retracted to the desired high to perform different movements depending on the needs of the user. It has a Mitchell mount on top to attach the fulcrum or a remote head on it in case it is needed.

The fulcrum is where the arm pivots in the pan and tilt axes. The information from the movement of the arm is gathered from here. It has a Mitchell mount on its base to operate the arm in different supports with it.

The Telescopic arm can be extended or retracted in order to reach different positions for the remote head. It has a counterweight support to keep the arm balanced in any position.

The Electronic box is the main brain of the crane. All the electronic components are located in the Electronic box and the Leveling Head.

The Leveling Head holds the real horizon automatically on its Mitchell mount when the telescopic arm moves up or down.

Besides the crane, there are some accessories needed in order to operate and to do regular maintenances on the crane such as the power unit or the counterweight supports for the dolly. In the following chapters there will be a brief description of every component on the crane and the adjustments that can be done by the user on each part.

2.1 DOLLY

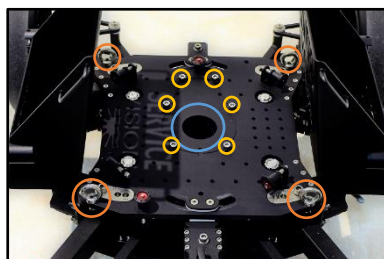


02.02 Light cranes Dolly.

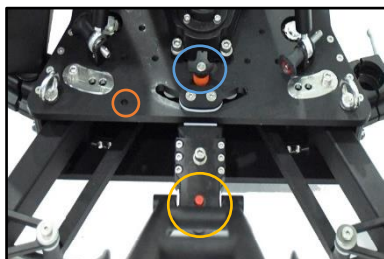
2.1.1 DOLLY BASE



02.03 Dolly sideview.
A - Supports for pushing bars.



02.04 Dolly base.
A - Mitchell mount.
B - Column attachment threads.
C - Strap rings.



02.05 Direction detail.
A - Locking pin.
B - Steering lock knob.
C - Storage pin position.

The dolly is the base of the crane, it is the same dolly for all the light cranes, and it can be pushed using 48mm or 50mm aluminum pipes attached into the supports (A in fig. 02.03). The bars are locked into the supports by tightening the white handle knobs in the supports. These supports can also be used as a locking point for the counterweight buckets. There are four supports for the pushing bars or the counterweight buckets, two per side.

The dolly also has four strap rings to hold the telescopic arm into the dolly when the arm is mounted (C in fig.02.04).

Note: Do not lift the crane from the strap rings. If the crane needs to be lifted, use straps under the chassis.

In the center of the dolly there is a Mitchell mount support (A in fig.02.04). If the column is not assembled into the dolly, it is possible to attach a remote head here. Notice that the dolly's base is threaded at M10 in case the user wants to attach different accessories to the dolly.

The dolly has 2 independent steering handles that allow the movement of the crane through tight corners. The steering handles can be locked introducing the locking pin (D10x40mm) in the locking direction position (fig.02.05). There is a storage position for the locking pin (C in fig.02.05) in case it is not locking the direction.

It is possible to easily remove the steering handle by unscrewing the screw (DIN912 M10x30mm) next to the steering locking knob on the steering handle support. This friction knob (C in fig.02.05), is used to apply friction on the vertical movement of the steering handle.

2.1.2 DOLLY WHEELS



02.06 Rubber wheel with locking pin.



02.06b Socket KM tool with 2 teeth cut.



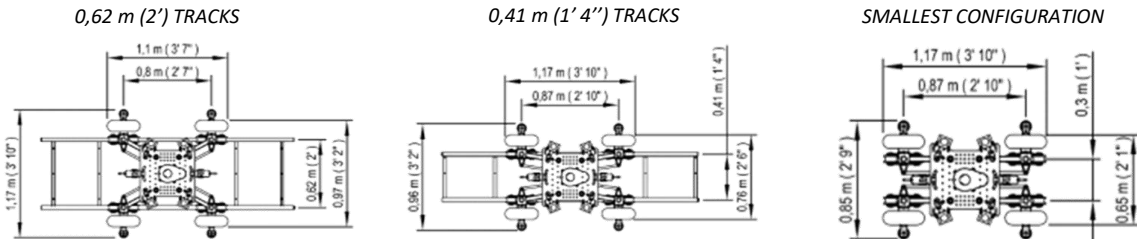
02.07 Leveling Jack attached.

The wheels are attached to the dolly with KM-11 nuts. To remove the wheels, remove the pin on the hub and loose the KM-11 (*metric 55x2*) nut using a 6 teeth KM tool or cutting 2 teeth from a 4 teeth tool (*fig.02.06b*).

On the inner side there are the pressure brakes of the wheels (*red handle on fig.02.09*). The holes inside the wheel hubs are prepared to receive the leveling jack's shafts and hold them with the locking pins for them (*08x60mm*). There is the possibility to change the wheels to pneumatic wheels to move the crane through rough terrains (*Ref. 7474*).

There is one leveling jack for each wheel. To move the crane around, they can be removed to reduce the width of the base. To operate the crane, the 4 of them need to be touching the ground and they may be used to level the base. To introduce the leveling jack, remove the locking pin, introduce the shaft of the jack through the wheel hub and lock it with the pin. Then bring the pad down using the *24mm ratchet wrench* provided with the crane.

2.1.3 ARTICULATED ARMS



02.08 Dolly configurations.



02.09 Loosen the arm screw.



02.10 Changing the dolly's arm position.

To change the dolly from one configuration to another the leveling jacks must be mounted in the wheels, and it can be done with the crane fully assembled. The telescopic arm needs to be strapped to the dolly. It is not needed to remove the counterweights or the remote head, but the arm needs to be completely retracted and secured with the pin (see [chapter 2.4 Telescopic arm](#)). Use all the leveling jacks to lift the dolly until the wheels can spin freely. Then, one at a time, loose the screw on the base of the articulated arm (*DIN912 M12x160mm*) and move the leg to the desired position with the hands to lock it again with the same screw (*fig.02.09-02.10*). Repeat the process for the rest of the dolly's articulated arms and lower the dolly base until the wheels touch the ground.

Note: The smallest configuration is only for transport, it is not safe to operate the crane with the dolly in this configuration.

2.1.4 TRACK WHEELS

The dolly can be used in different tracks depending on the articulated arms configuration. To do this, the track wheels need to be assembled into the dolly as shown in this chapter:



02.11 Track wheel disassembled.

A – Pin from the track wheels.

To fix or remove the tracking wheels they need to be introduced under the chassis of the dolly, next to the rubber wheels with the positioner pin of the track wheels facing top (fig. 02.11).

Once the pin is aligned under the hub, it can be locked in place by screwing the red knob on top. In case it is needed, this red knob can be removed by pulling it up and unscrewing it at the same time.

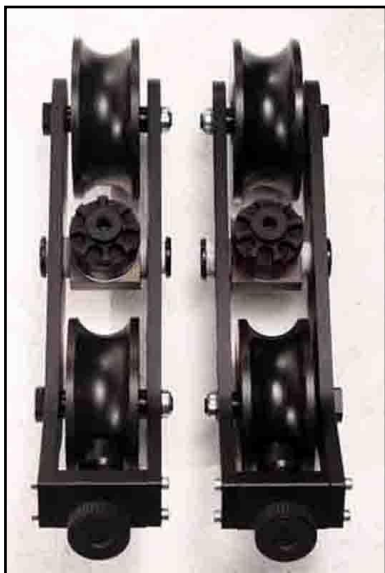


02.12 Track wheel assembled.

Once the track wheels are assembled, the crane can be introduced into the tracks using a ramp. In case the user wants to stop the dolly in any position, there are brakes on each track wheel to lock it in place. The leveling jacks can also be used as brakes.

Note: Ensure that the track is leveled before mounting the crane on it.

Notice before assembling the track wheels that there are 2 of them with a movable axis side to side and 2 fixed. This is to correct the minor differences between both sides of the track. To make this system work properly, mount the same kind of track wheels (movable or fix) at the same dolly's side.



02.13 Different track wheels.

Important note: When using the travelling wheels, DO NOT leave the crane mounted in tracks overnight, the track wheels may get flat if they are long periods of time in the same position.

2.2 COLUMN

The dolly comes with a two-section telescopic column with a Mitchel mount support on top.



02.14 10'/17'/23'L Column.

- A – Tensor support point.
- B – Column bracer nut.
- C – Column raising point.

It is attached to the base of the dolly with 6 screws (*DIN912 M10x25mm*) shown in *fig.02.04*. There is only one position to assemble it. Once it is mounted, there are 4 tensor bars that locks the column in place and prevent it to flex. To attach them, use the locking pins (*D10x25mm*) in the base of the dolly and adjust the length of the tensors to match the holes in the column (*fig. 02.14*). Then secure them to the column and tight the tensors by hand to prevent the column to flex while using the crane.

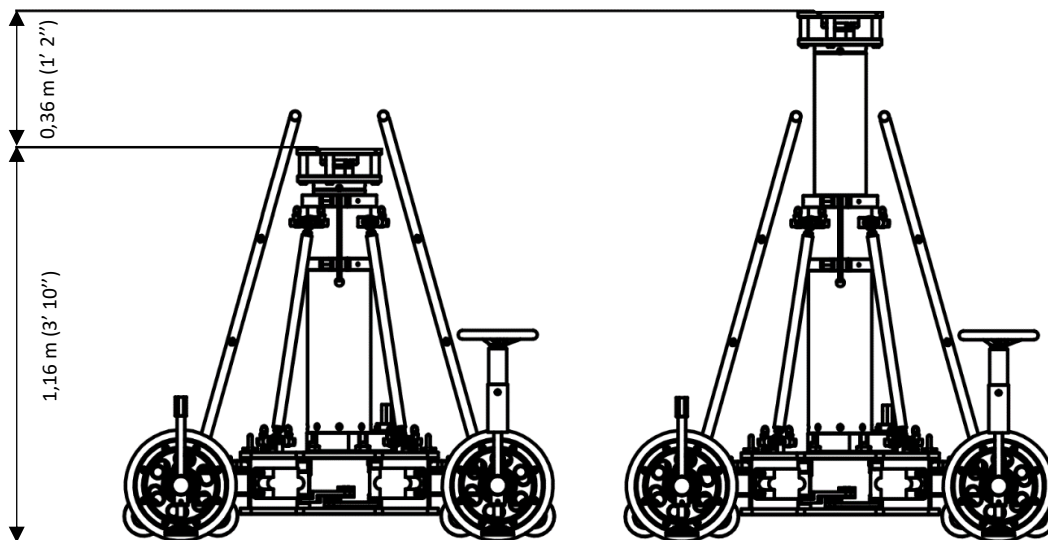
To change the height of the column, loose the column bracer nuts (*B in fig. 02.14*) and use the column lifting mechanism to do so. The column lifting mechanism (*C in fig.02.14*) can be operated with a 24mm ratchet wrench and a drill using a drill adaptor.

Notice that to loosen up the lower column nuts, the tensors can be removed to access easily with a 24mm ratchet wrench (*a fix wrench can be used sideways without removing the tensors*).

There is a white mark in the limit of the column section to acknowledge when the limit has been reached and stop telescoping the column out. Once the desired high is achieved, tight the column nuts again by cross tighten both sides equally.



02.15 Visual limit column mark.



02.16 Column max and min size.

Note: If the arm is assembled, before lifting the column balance the arm with the CW carriage in the center of the column, remove the arm straps, fix the pan & tilt brakes, and ensure the column bolts are loose.

2.3 FULCRUM

The fulcrum is where the crane arm pivots in pan and tilt axes.



02.17 Fulcrum.

A – Encoder connectors.

B – Pan fluid.

C – Arm locking point.



02.18 Tilt and Pan encoders.

The fulcrum has encoders on the right side connected to the Electronic box. Those encoders are linked to the fulcrum by belts and inform the E.B. regarding any change in the position of the arm. That information is used to display data in the portable display and to perform functions as the Arc compensation or the motion generator among other functions.

Both encoders give the same kind of signal and have the same pinout. For troubleshooting they can be swapped to check if the signal in the electronic box is received. The cables for the encoder also have the same pinout but different color. The differences are the housing and the color code of the connector (blue for tilt and grey for pan).

Note: in the [chapter 6.4.1.2: Encoder belts](#) there are instructions on how to access and change the encoder belts.

Commercial references for encoder belts:

	Pan belt	Tilt belt
Scorpio 10'	5T2.5 540	5T2.5 540
Scorpio 17'	5T2.5 600	5T2.5 540
Scorpio 23'L	5T2.5 600	5T2.5 540



02.19 Fulcrum brakes side.

A – Tilt fluid.

There is only one way to mount the arm into the fulcrum since one side is wider than the other. To lock the arm into the fulcrum, there are two locking points under the arm support point in the fulcrum (C in fig.02.17) where two knobs or two screws (M8x25mm) lock the arm depending on the model of the crane.

On the left side of the fulcrum there are two brake screws (fig.02.19). The brakes are not blockers: when they are used, the crane is just hold in place by friction pads and it can be moved if the force applied to move it is stronger than the friction of the pads. There is a slot for a M10 Allen key to operate the PAN brakes and the TILT on the Scorpio 10'. On the Scorpio 17' and the Scorpio 23'L there is a handwheel to operate the TILT brake. If the crane needs to be blocked, always use straps to lock it instead of these brakes.

On top of the brakes side, next to the pivot axis there is the screw for the tilt friction (A in fig.02.19). If the user wants to adjust the friction on the tilt axis this screw can be tight to stiffen the tilt movement or loosen to make it softer. The pan axis adjustment can be done in the bottom part of the fulcrum (B in fig.02.17).

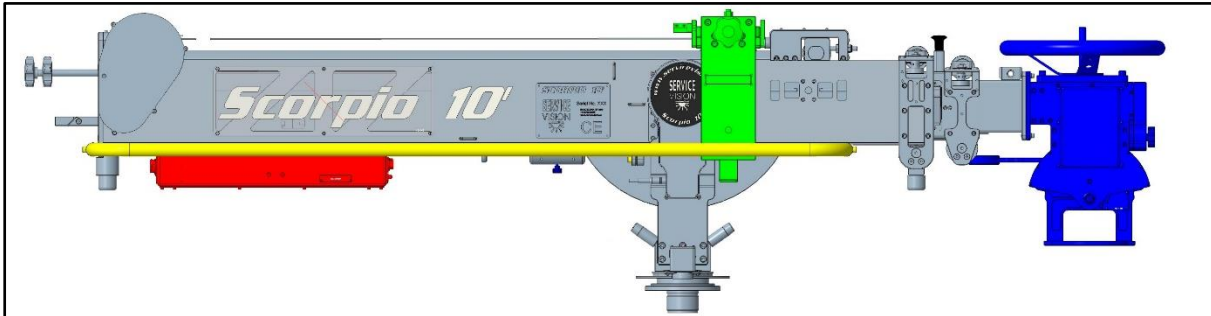


02.20 Fulcrum's Mitchell mount.

The fulcrum has a Mitchell mount so the cranes arms can be mounted either in their own dolly or any other dolly or support with a Mitchell mount on it. The support must be able to hold the arm in its maximum payload.

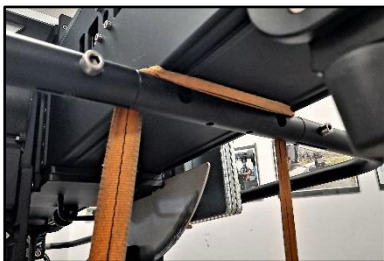
2.4 TELESCOPIC ARM

The arms of the cranes are made up of one main arm and telescopic sections that extends or retracts automatically controlled by an operator with the Hand Command. In this chapter we will focus on the different parts build on the arm, securities, and the mechanic components on it.



02.21 Scorpio 10' Arm retracted with color coded parts.

The basic components of the telescopic arm are the counterweight carriage (*light green*), the levelling head (*blue*) at the end of the telescopic sections, the electronic box (*red*) which controls the system, the side protection bars (*yellow*) and the rear counterweight support on the back of the arm.



02.22b Front strap point.

The arm is slipped into the fulcrum and then is locked from below with two knobs or two screws ($M8 \times 25mm$) depending on the crane model. Once the arm is locked and empty, it will always be heavier on the back part of it. The front strap must be always strapped once it is assembled (*fig.02.22b*), and it is highly recommended to strap the back part of the arm to ensure it is safely stored.

Note: At this point, with the arm positioned on the fulcrum with no payload, the arm will be BACK HEAVY. DO NOT REMOVE THE FRONT STRAP WITHOUT BALANCING IT.

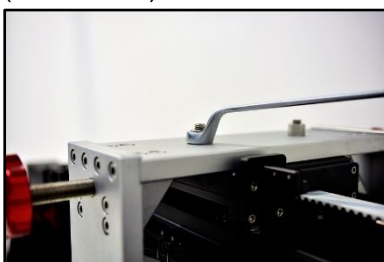


02.22 Telescopic sections locking pin.

The arm of the cranes consists in different aluminum sections but there is always one fix (*called Main Arm*) which supports the other telescopic sections. The telescopic sections are locked between them with a safety pin ($D10 \times 35mm$) to prevent them to extend while transporting the arm (*fig.02.22*).

2.4.1 MAIN ARM

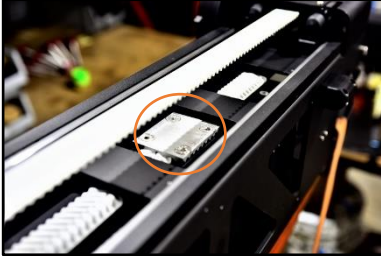
The Main section is the fix part that holds the rest of the components detailed before. Underneath of it there are four support legs to rest the arm on them if is not assembled. Under the main arm there is also the Electronic box (*E.B.*). It slides from any side of the arm and it is locked with four knobs ($M5 \times 16mm$). It controls the arm motor and manages all the interaction with the user and the rest of the components on the arm.



02.23 Counterweight carriage attached.

The counterweights support is attached to the counterweight carriage with two nuts ($19mm$). This counterweight carriage is used to balance the telescopic range of the arm. The function of this support is detailed in the [chapter 3.4 Balance](#).

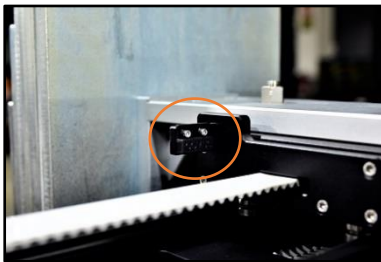
Inside the back part of the main arm there is the arm motor. This motor transmits the movement to the first section belt using an internal belt and pulleys. The first section belt is attached to the first section (*fig.02.24*) and to the counterweight carriage. When the motor moves the belt, the first section telescopes in one direction and the counterweight carriage moves on the opposite direction in order to keep the arm balanced.



02.24 Attachment plate to the first section.



02.25 Extended magnetic limit.



02.26 Carriage magnet.



02.27 Rear counterweight support.

Note: in the [chapter 6.4.1.3 Main motor](#) there are instructions on how to access and change the motor and its belt.

Commercial reference for internal motor belt:

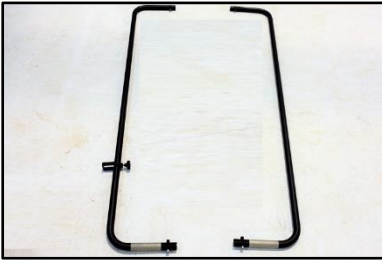
Scorpio 10'	For s/n 001 to s/n 090: T5 590	Rest of s/n: 600-5M-9
Scorpio 17'	For s/n 001 to s/n 003: T5 830	Rest of s/n: 835-5M-HT
Scorpio 23'L	For s/n 001 to s/n 007: T5 830	Rest of s/n: 835-5M-HT

The motor for the Scorpio 17' and the Scorpio 23'L is the same but the motor for the Scorpio 10' is different. There is a detection system inside the Electronic Box to identify which kind of motor is connected. It is possible swap the electronic box from one crane to another by making some internal adjustments (see [chapter Replacement of the Electronic box](#)).

The range of movement of these motors is limited by software to the length of the arm but the system does not know where to start that range. In order to know where the limits of movement are, the Scorpio cranes have two magnetic sensors to determinate the retracted physical limit and the extended physical limit of the arm. The extended magnetic limit (*fig.02.25*) detects the magnet on the counterweight carriage (*fig.02.26*) once the carriage gets close to the limit on the rear part of the arm. The retracted limit detects a magnet attached to the right side of the first section (*fig.02.34*) when the first section gets close to the rear part of the arm. These magnetic limits are located in the rear part of the arm and are connected to the E.B. through the motor connector. The sensors detect the magnetic field of the magnet and determinates where the limits of the arm are. The detection of the magnetic field of the magnet may vary depending on the speed of the arm arriving to these sensors.

On the back part of the crane there is the rear counterweight support (*fig.02.27*) where weights can be added in order to balance the crane. The function of this support is detailed in the [chapter 3.4 Balance](#).

2.4.2 OPERATION BARS



02.28 Protection bars.

There are two pivots in both sides of the main arm, two in the front part of the arm and two in the back. These pivots are used for fixing the Protection bars (*fig.02.28*) to the crane. In these pivots is where the screw that holds the side Protection bars are screwed (*DIN912 M8x45mm*). Notice that both side protection bars are equal. The hand command bracket must be introduced into the side bar before mounting it into the arm. There are sliding weights available to attach on these protection sidebars.



Note: The protection bars mark the area of movement of the Telescopic counterweights, therefore NEVER get in between the protection bars and the crane, there is a high risk of squashing if the crane moves. These bars are used by the operator to control the movement of the crane.



02.28b Lower operation bar

When the column is fully lifted it is hard to operate the arm using the protection bars. There is an accessory bar (*fig.02.28b*) for those situations where the operation bars are too high to control the arm of the crane.

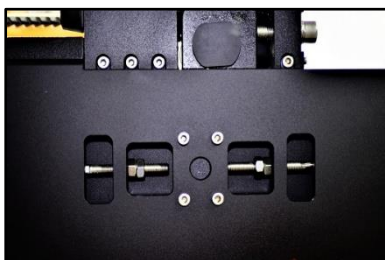
2.4.3 TELESCOPIC SECTIONS



02.29 Telescopic sections of the arm.

The Scorpio light crane series have two or three telescopic sections depending on the model. Each section is supported in the previous section by a system of guide wheels, rails, and pulleys. The *first section* is the next to the main section, the *second section* is the next (and the last on the Scorpio 10) and the *third* is the last arm section of the 17' and the 23'L. The *third section* is moved with the same principle than the second section.

The first section is directly moved through the white belt on top of the main section (fig. 02.24). The movement of the second section is linked to the movement of the first one through two linen pulleys attached to the first section (for the Scorpio 10' there is only one pulley on the right side of the arm). Those pulleys run a closed-circuit cable that is linked in one side on the main section and on the other side to the second section.



02.30 Attachment to the main section of the closed cable system.



02.31 Attachment on the second section of the cable system.

When the first section is moved by the motor, the linen pulleys move pushing the second section in the same direction of the first one since the closed-circuit cable is fix in the main section.

Each section is supported all the time by four points: two support points in the previous section's front wheels (fig.02.32) and two in the back part of the section with its own wheels. Those wheels run along rails underneath the telescopic sections and inside the previous section.

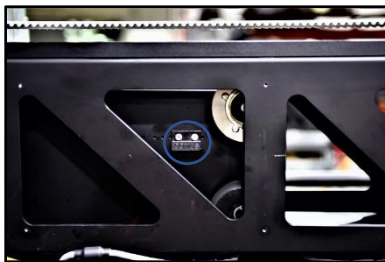


02.32 Front wheels from the main arm.



02.33 Front wheels from the first section.

These sets of wheels are eccentric on the right side of the pictures. In the right side of the axel there is one dot marking the highest point of the eccentric side of the axis.

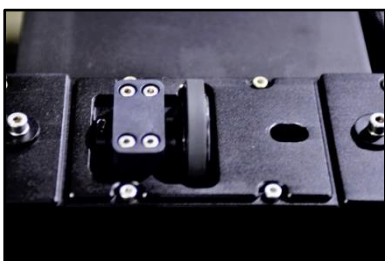


02.34 Rear support wheels first section.

S – Magnet for retracted limit.



02.35 Guiding lateral wheel.



02.36 Top guiding wheel and locking point of the main section.



02.37 Cable holders and cable diverter.

The rear parts of the telescopic sections have two sets of wheels: metallic wheels on the top part and rubber in the bottom part. When the crane telescopes out and is heavier in the front part, it is still straight and aligned because it is supported by the top wheels on the rear part. If the section is back heavier, the rubber wheels support the section. Always four support points for each section.

The inner wheels have eccentric axel as the ones in the front. The second section also has internal lateral rubber wheels on the back part of it to prevent it to flex laterally.

To ensure the straight movement of the arm when telescoping, there are guiding wheels on top of all the sections but the last one. These guiding wheels are mounted in eccentric axel to be able to adjust the movement of the sections when telescoping (*fig.02.35*). By loosen the top screw, they can be approached or moved away by introducing a pin into the holes of the axel to move it.

The top guiding wheels are eccentric too (*fig.02.36*). To adjust them, loosen up the four Allen screws that holds the eccentric shaft in place and move the axis with a pin from the left holes of the axel.

These wheels are only guiding wheels which means they do not need to pressure the inner section, just ensure that with the lateral movements there will not be big vibrations getting into the section.

Note: Any bad adjustment made in the telescopic arm can damage the crane beyond repair, ONLY QUALIFIED PERSONNEL can do the adjustment of the arm.

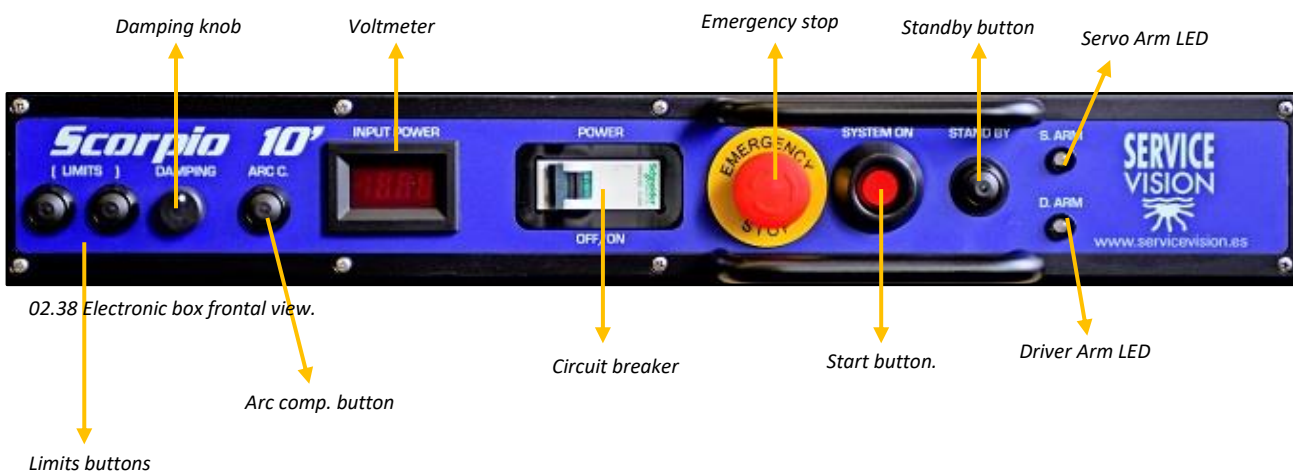
Along the crane, there are cable holders to support the cables going into the leveling head and the remote head. The cable holders move with the crane, if more cables are added, ensure that the length of them is enough to reach the remote head with the arm fully extended.

2.5 ELECTRONIC BOX (E.B.)

The electronic box is in the rear bottom part of the main section. It has all the electronic components to control the position of the arm and move the motor located inside the arm. It has a detachable display that could be mounted in the left side of the main arm (*or completely removed*). This detachable display will allow the user to use all the functions on the crane such as memories, stop sequence or motion generator and allows the user to adjust the potentiometers on the hand command.

Next is detailed the parts of the electronic box and a brief description of each component.

2.5.1 OUTSIDE DESCRIPTION



LIMIT BUTTONS: With these buttons it is possible to set electronic limits to the movement of the arm. The left one is for the extended limit and the right one for the retracted limit. Those can be used independently, there is no need to set both limits to use only one.

DAMPING KNOB: Potentiometer to adjust the stopping ramp of the arm when moving. If the portable display is plugged, this knob will not work; the one in the portable display will determine the stopping ramps of the arm.

ARC C. BUTTON: This button will activate the arc compensation function ([see chapter 4.2.3.4 Arc comp.](#))

VOLTMETER: The information of the voltage arriving to the crane will be displayed here. The status of the batteries can be checked in here if batteries are being used.

CIRCUIT BREAKER: This breaker protects the crane against current peaks coming to the system. If it is OFF the crane cannot be activated.

EMERGENCY STOP: This emergency stop button cuts the power from the system; it has to be released in order to start the E.B. ([see chapter 3.2 Start-up](#)).

START BUTTON: This button is used to activate the Electronic Box. Certain conditions need to be fulfilled prior start the crane ([see chapter 3.2 Start-up](#)).

STANDBY BUTTON: This button will make the arm go to standby mode. In the [chapter 3.3 Working modes](#) it is explained how this mode works.

S ARM LED: This LED informs of the status of the SERVO board controlling the telescopic arm motor. There are three possible status: OFF (*there is no power in the board*), RED (*the board has power but no communication with the CCU*) and GREEN (*power and communication arrive to the board*).

D. ARM LED: This LED indicate the status of the Amplifier for the telescopic arm motor. There are three possible status: OFF (*there is no power in the amplifier*), RED (*the amplifier has power, but the motor is disengaged*) and GREEN (*the motor is engaged and controlled by the system*).



02.39 Side connectors 1.

CONTROL INTERFACE: This connector communicates the Electronic box with a Scorpio Control in case there is a Scorpio Head mounted. It sends information of the position of the crane to use functions as Back Pan or Tracking (*To know more about these functions, see the [chapter 8 Special configurations: Interface with Scorpio Heads](#)*).

12v/3A DC OUT: Power output for DC monitors.

LEVELING HEAD: This connector sends the tilt encoder signal, power, and communication to the leveling head.

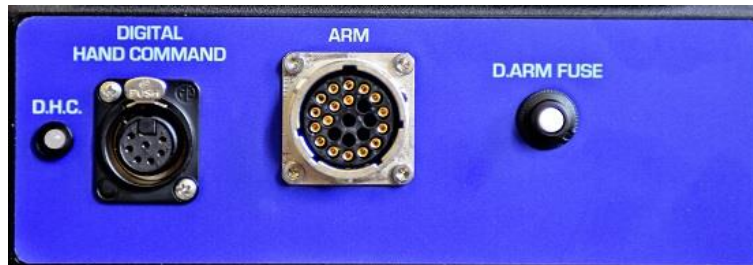
30V DC IN: This is the Power input connector for the crane. The power requirements for the crane are specified in the technical information.

DISPLAY COMMAND: connects the portable display and the damping knob to the electronic box.

ENCODERS OUT: This connector gives an output of the encoder data used in augmented reality or other scenarios (*see the [chapter 8.4 M.G. with Scorpio Focus](#) or [chapter 8.5 Augmented reality](#)*).

L.H. FUSE: this is a resettable fuse. In the event of the cable going to the Leveling head breaks, this fuse will disconnect the power for the leveling head and will pop out. To reset it, push it back in.

ENCODERS: These connectors receive the information of the encoders in the crane. (*to see the position of the pan and tilt encoders go to [chapter 2.3. Fulcrum](#)*). There is a third encoder input called travelling. The electronic box is prepared for receiving the position of an encoder attached in the tracks in order to send the position of the crane along the track on the encoders out connector.



02.40 Side connectors 2.

D.H.C.: This is the LED for the digital hand command status. It should be always *GREEN* if the hand command is connected. Other ways it will be *OFF*.

DIGITAL HAND COMMAND: connects the crane with the hand command. it has to be connected in order to start the E.B. (*see [chapter 3.2 Start-up](#)*).

ARM: The motor for the telescopic arm and the magnetic limits of the arm are connected here. The Electronic Box will identify the model of crane using this connector since each motor has different jumpers on the aerial connector. The motor for the S17' and the S23'L is the same model but different jumper.

D. ARM FUSE: This is a resettable fuse. In the event of the cable going to the arm motor breaks, this fuse will disconnect the power for the motor and will pop out to prevent major damage to the equipment. To reset it, push it back in.



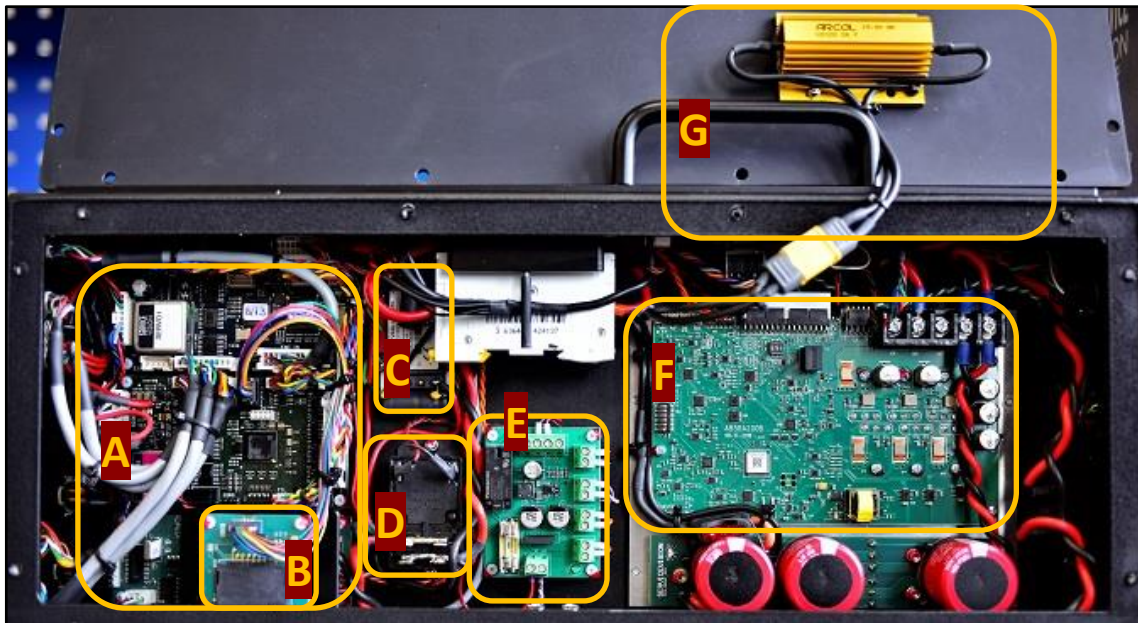
02.41 Portable display

PORTABLE DISPLAY: In this display the information of the system is showed, it can be attached in the main arm with a special bracket. If it is connected, the damping knob of the portable display will determinate the stopping ramps of the arm.

Note: For PINOUT references go to [chapter PINOUTS](#)

2.5.2 INSIDE THE ELECTRONIC BOX

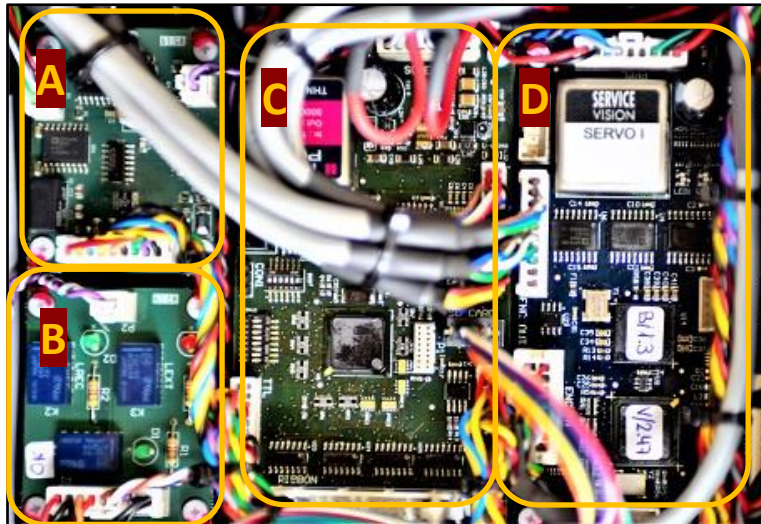
The electronic box has different electronic components and amplifiers to control the crane. In this chapter we will make a brief description of some of them. Notice they might be slightly different depending on the model of the crane.



02.42 Inside components in the S10' EB v2.

- A. Electronic components:** These components are detailed in the next page.
- B. SD Card slot and reader:** This SD Card Reader is used to write memories inside an SD Card or to update software for the different boards inside the electronic box.
- C. Voltage regulator:** This regulator gives 12V 3A DC output for the monitor output.
- D. Activation relay:** This relay cuts the power for all the electronics on the crane. It is controlled by the Security system board.
- E. Security system board:** This board controls the safeties of the crane: If the emergency button is released, the hand command connected and the start button is pressed it will allow the system to start, other ways the crane CANNOT be started, even if the LED system power is ON. It also has a 2Amp. Fuse.
- F. Driver for the ARM:** This is the driver board for the arm. It amplifies the signals from the SERVO of the arm to move the telescopic motor. It is powered by DC. The driver for the S10' is different from the driver for the S17'/S23'L
- G. Shunt resistor:** This component dissipates the current generated by the motor. Depending on the model of the crane this shunt may vary.

Note: In case one of the fuses is blown, in the [chapter Fuses](#) from the F.A.Q. chapter there is a list of all the fuses of the crane and the observable symptom

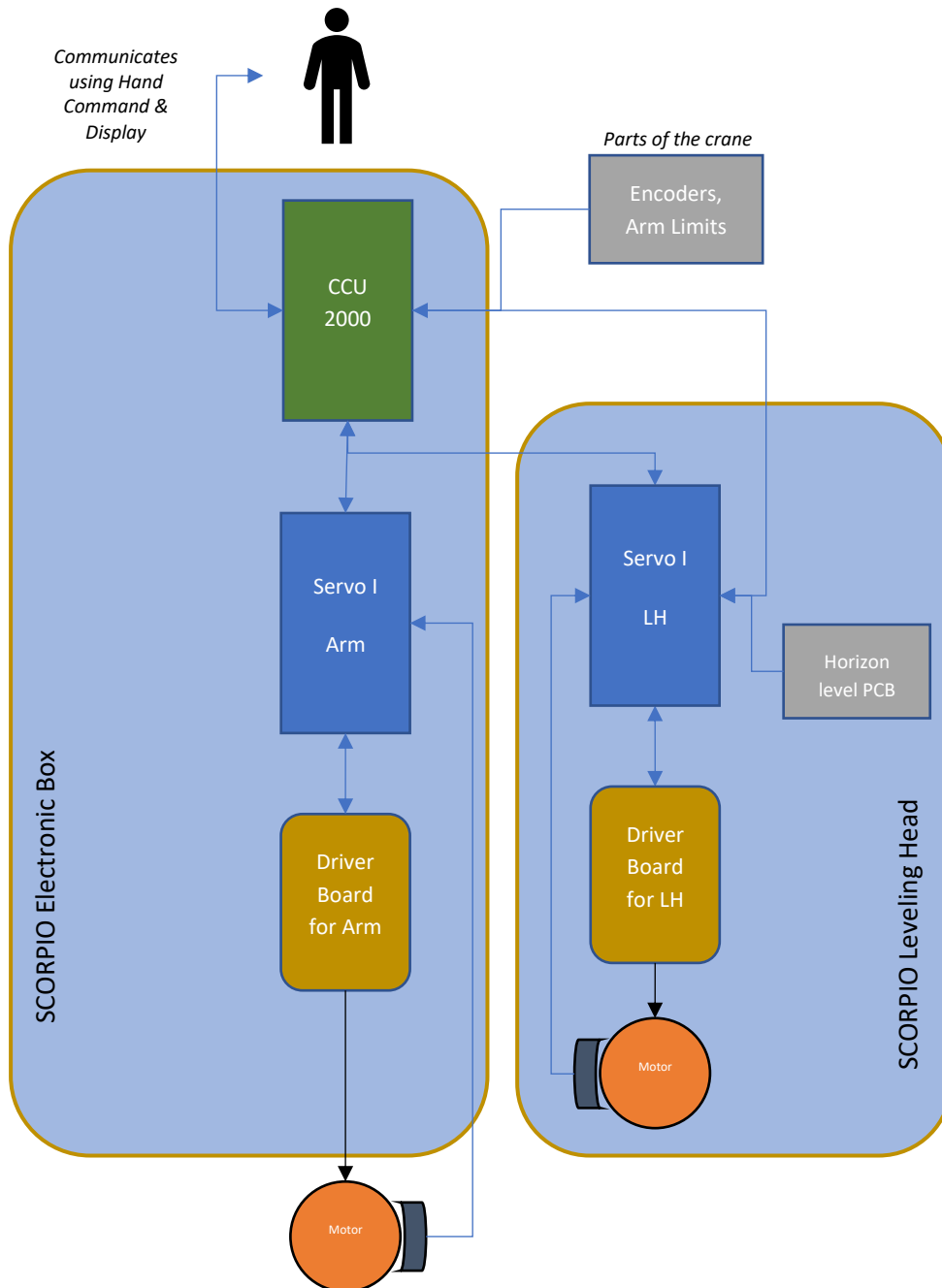


02.43 Electronic components in the EB.

- A. Digital board for Hand Command:** This board communicates with a digital board inside the Hand Command. It translates the information from the Hand Command into the CCU.
- B. Relay board for ARM and H.C.:** Receive the information of the Magnetic limits of the crane and translates it to the CCU. The red LED is for the extended limit and the green LED is for retracted. If it detects the limit the correspondent LED will switch off. It also informs the Security system board that the Hand Command is connected.
- C. CCU:** This board is the Central Control Unit (CCU). It is the board that controls all the interaction with the user such as the Display or the Hand Command. It also receives the information of the encoders of the crane and control all the axis of the crane using Servo Boards.
- D. Servo board for the ARM:** This Servo board controls the movement of the Arm. It receives information from the CCU and sends a signal to the driver. The driver moves the motor and the encoder from the motor sends information back to the servo.

2.5.3 KEY CONCEPTS

All the Scorpio Systems works in a similar way: The user interface with the system using different kind of peripherals (*the hand command to tell the system to move or the display to read information and use functions for example*). The CCU board is the one that manages this interaction. Depending on the specific function that the system has to do (*which motor has to move for example*), it sends the order to the proper Servo board. This Servo board uses a driver or amplifier to move the motor assigned to it. There are control systems attached to the motors (*encoder for example*) to control the position of the motor and give this information back to the Servo.



2.6 HAND COMMAND

The Hand command for the Scorpio Cranes has a digital board inside that controls the functions of the different buttons and Rockers of the Hand Command (H.C.) and communicates with the Electronic box using a serial communication protocol.



02.44 Hand command (Ref.7021).

In case the hand command could not communicate with the electronic box (*either because the cable is broken or disconnected*) the crane will automatically switch off and will not start until the communication with the Hand command is restored ([see chapter 7.3 Possible problems related to the arm](#)).

The different components of the hand command are:

STOP BUTTON: When pressed automatically switches off the crane.

LED of digital board: Indicates if the hand command is communicating with the electronic box. Red means that there is power in the hand command but no communication and green means there is power and communication with the electronic box.

ROCKER: Allows to move the motor inside the telescopic arm or the motor in the column if it has one connected to the Electronic Box. The T will telescope the crane out or move the column up and the W will telescope the crane inside or move the column down in case the crane has the column motorized.

GREEN BUTTON: It is the main action button. It has different functions depending on the screen showed in the portable display. If it is pressed while the main screen is showed it will activate or deactivate the Arc comp feature. If it is held and the rocker is pressed, the counterweights motor is moved (*In case there is a CW motor*). In the [chapter 4.2.3.7: Hand Command buttons](#) there are all the functions clarified.



02.45 Bottom view Hand Command.



02.46 Top view Hand command.

ORANGE/BLUE BUTTON: These buttons can be configured to use different functions (*In the [chapter 4.2.3.7: Hand Command](#) it is explained the functions of these buttons*).

SPEED KNOB: It adjusts the speed of the rocker. It goes from 1% to 100%. If the speed is reduced under 5% the display will show "very low speed".

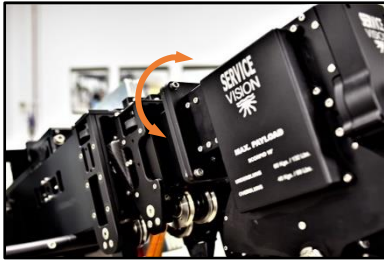
HAND COMMAND CONNECTOR: Connects the hand command with the electronic box.

Note: For PINOUT references go to [chapter PINOUTS](#)

2.7 LEVELING HEAD (L.H.)

The Leveling Head (*L.H.*) is the component of the crane that holds the horizon when the crane moves up and down. It has a Mitchell mount on it to mount any kind of head with this mount.

It is located at the end of the telescopic sections, and it can be mounted underslung or over slung. The function of the leveling head is to hold the horizon vertically. It only corrects the level in the same direction than the arm is facing.



02.47 Lateral level adjust from the L.H.

To adjust the lateral level, loose the 4 screws from the leveling head and move it laterally along the slotted holes to correct the lateral offset on the leveling head (*fig.02.47*). To attach the leveling head into the arm, tight the 4 screws to the arm.

The leveling head is connected with the E.B. by cable (*fig.02.48*). These kinds of connectors need to be aligned and then twist clockwise from the metallic part of the male connector until they are secured.



02.48 Lateral of the L.H.

On the side of the Leveling head, aside the L.H. connector, there are two switches and two LEDs:

The MANUAL or AUTO switch defines how the leveling head is going to find the level. In the AUTO position, as soon as the L.H. starts it will automatically find the real horizon and it will hold it while the operation.

The MANUAL position allows the user to adjust manually the level to be hold by turning the knob at the end of the L.H. to the desired position (*Only without power on the L.H.*). The system will hold that position as soon as it is started.



02.49 L.H. Switches.

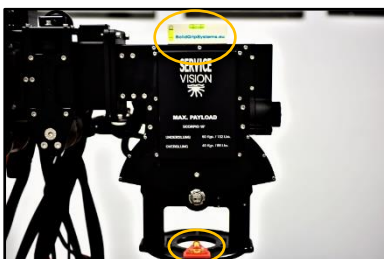
The L.H. ADJUST switch is used to calibrate the real horizon sensors. To do so, with the crane OFF tilt the arm until the leveling head is leveled (*a bubble level can be used*). Once the chassis of the L.H. is leveled, move the Mitchell mount plate using the knob at the end of the L.H. to the horizon level (*fig.02.51*). Then start the crane WHILE pressing this switch either down or up (*it is not important if is the A or B position*). The S.L.H. LED will flash ORANGE. Once it passes to green the switch can be released and the new horizon will be set into the L.H.



02.50 L.H. Front knob.

There are two LEDs on top of the connector:

S L.H.: This LED informs of the status of the SERVO board controlling the L.H. motor: OFF (*there is no power in the board*), RED (*the board has power but no communication with the CCU*) and GREEN (*power and communication arrive to the board*). Fix ORANGE means it is recording internal data (*introducing new value for horizon, software update...*) and if it flashes ORANGE, gives information regarding the status of the internal sensors according to the table in the [chapter 7.1](#)



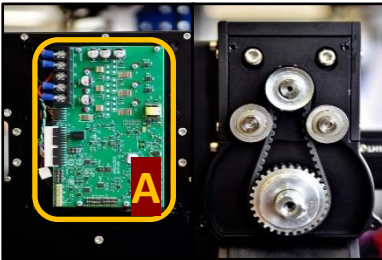
02.51 L.H. Horizon adjust using levels.

[Possible problems related to the LH.](#)

D L.H.: This LED indicates the status of the Amplifier of the L.H. motor. There are three possible states: OFF (*there is no power in the amplifier*), RED (*the amplifier has power, but the motor is disengaged*) and GREEN (*the motor is engaged and controlled by the system*).

2.7.1 INSIDE THE LEVELING HEAD

The Leveling Head has a motor mounted parallel to the Mitchell and transmits the movement to an endless screw to move the half-moon gear. Under the front cover there is access to the transmission belt from the motor (*fig.02.52*). Under the cover labeled with the weights specifications there is access to the driver board and under the inside cover there is access to the electronics of the Leveling Head (*fig.02.53*).

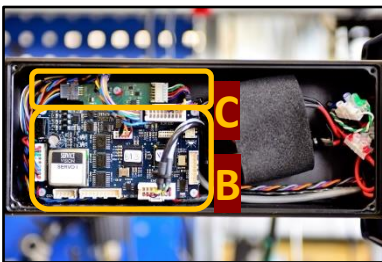


02.52 L.H. Driver & front cover open.

To tight the belt, loose the 4 screws holding the motor and push the motor to give tension to the belt. To remove it, lose the 4 screws and the tension of the belt will be released.

- Commercial reference for LH motor belt: RPP5 265

A. Driver for the L.H.: This is the driver board for the motor inside the L.H. It amplifies the signals from the SERVO of the arm to move the motor. It is powered by DC voltage from the E.B.



02.53 L.H. internal cover.

B. Servo board for the LH: This Servo board controls the axis of the LH. It receives information from the CCU, the Encoder in the tilt of the crane and the Level reading PCB and processes all that information to move the motor inside the L.H. in order to find the proper level.

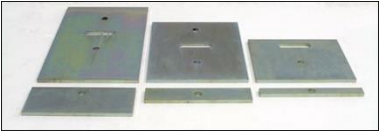


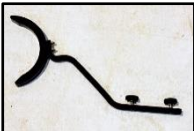


C. Level reading PCB: This PCB reads the level of the crane and the level of the Mitchel mount and sends the signal to the servo to find the real horizon.






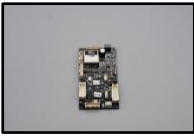
***In the Underslung position the LH can handle 60kg/132lbs.
In the Over slung position 40kg/88lbs. maximum. The maximum load may vary depending on the model of the crane used.***






2.8 CRANE ACCESSORIES





Besides the crane there is a list of different accessories included in order to operate the crane properly or do maintenances to it. Below is shown a list of all the accessories for the Scorpio light cranes included or not.

2.8.1 ARM ACCESSORIES

Component	Ref.	Qty. 23'L	Qty. 17'	Qty. 10'	Description
Set of Counterweights 	7054 7056 7057 7058 7059	23 3 2 2 2	22 3 2 2 2	14 3 2 2 2	Counterweight 15 Kg. Counterweight 8 Kg. Counterweight 4 Kg. Counterweight 2 Kg. Counterweight 1 Kg. They are used to balance the crane.
S10'/S17'/S23'L Weights dolly 	7420	2	2	1	To transport the counterweights with the crane.
S10'/S17'/S23'L Security strap 	7421	2	2	2	The straps are used to secure the arm into the dolly for safely transport it. It is mandatory to have the crane strapped if there is no one operating it.
S10'/S17'/S23'L' Arm cable diverter cable 	7432	1	1	1	Diverter attached on the leveling head to separate the arm loom from the remote head.
S10'/S17'/S23'L Hand command bracket 	7418	1	1	1	Used to hold the hand command into the protection bar
S10'/S17'/S23'L Digital hand command 	7406	1 (1)	1 (1)	1 (1)	There is an extra hand command for the crane

S10'/S17'/S23'L Hand command cable 	Hand	7407	1 (1)	1 (1)	1 (1)	Short cable for hand command (2,5m.) Long cable for hand command (5m.)
		7405	1	1	1	
S10'/S17'/S23'L Leveling head cable 	Leveling	7409	1 (1)	1 (1)	1 (1)	Cable to communicate the leveling head with the Electronic box.
		7803				
7953						
S10'/S17'/S23'L DC Power cable 	DC	7408	1	1	1	This cable provides power from the P.U. or batteries to the crane.
S10'/S17'/S23'L Encoder cables 	Encoder	7411		1	1	S10' Encoder cable for pan axis (grey) S10' Encoder cable for tilt axis (blue) S10' Encoder cable for travelling (red) S23'L Encoder cable for pan axis (grey) S23'L Encoder cable for tilt axis (blue) S23'L Encoder cable for travelling (red)
		7410		1	1	
		7412		1	1	
		7963	1			
		7962	1			
		7964	1			
S10'/S17'/S23'L Arm Set of tools (7460/7899/7999) 	Arm Set of tools	0067	1	1	1	18-19mm fix ring wrench
		2482	1	1	1	Allen key set
		7431	1	1	1	Mitchell mount tool
		7422	1	1	1	S10' 10mm Allen key
		7438	1	1	1	S10' tool for CW belt adjustment
Servo I 	Servo I	7658	1	1	1	There are different digital boards inside the Electronic box. To understand the function of each board and identify which one could have a problem see the chapter 2.5.3 Key concepts . Also, the LEDs outside the Electronic box and the LH gives information about the status of the boards.
S10' Arm Hardware spares	S10' Arm Hardware spares	7437	2	2	2	S10'/S17'/S23'L Fixing nut for counterweights support.
		7416			2	S10' CW Locking screw with aluminum knob.
		7807		2		S17' CW Locking screw with aluminum knob.

	7957	2				S23'L CW Locking screw with aluminum knob.
	7426	1	1	1		S10' CW Locking aluminum knob.
	7429	4 (2)	4 (2)	4 (2)		S10' Plastic knob screw to fix E.B. M5x16mm.
	7423		2 (2)	2 (2)		S10' Plastic knob screw to fix arm M8x25mm.
	7967	2 (2)				S23'L Screw to fix arm to fulcrum DIN912 M8x25mm.
	7811	4	4	4		S10'/S17'/S23'L Screw and washer for side protection bar
	7424	1 (1)	1 (1)	1 (1)		S10' Holder pin to block arm D10x35mm.
	7425	4 (4)	4 (4)	4 (4)		S10' Leveling head fixing screw DIN 912 M6x25mm.
S10'/S17'/S23'L Set of spare belts 	7427 7428 7430 7808 7809 7810			1 (1) 1 (1) 1 (1) 1 (1) 1 (1) 1 (1)		S10' Arm motor belt 600-5M-9 Encoder belt T2.5 540 Levelling head belt RPP5 265 Encoder belt T2.5 600 Encoder belt T2.5 540 S17'/S23'L Arm motor belt 835-5M-HT
Kit of fuses 	0213 0212 7475	1 1 2	1 (1) 1 (1) 1 (1)	1 (1) 1 (1)		2A FUSE for the security circuit board 10A FUSE for the Shunt resistor 15A FUSE for power unit 40A.
S10'/S17'/S23'L Power unit 40A (option) 	7472	1	1	1		The P.U. is a 30v 40Amp power supply. It has a 15Amp fuse in the back part. It is powered from AC current and has four 3pin XLR outputs to power the remote head and the crane.
S10'/S17'/S23'L Power-Communication & Video line for Scorpio Heads (optional) 	7433 7802 7951		1	1		This loom provides any Scorpio head power, communication and a video line going through the crane to the base of the dolly.
S10'/S17'/S23'L Portable display (optional) 	7403	1	1	1		The Portable display allows the user to do more functions with the crane and also displays useful information for the user.

<p>S10'/S17'/S23'L Portable display cable (optional)</p> 	7404	1 (1)	1 (1)	1 (1)	85cm cable to connect the portable display.
<p>S10' Lift bars (optional)</p> 	7469			4	These bars are used to lift the arm in order to introduce it into the fulcrum. They come with a locking pin to secure them into the arm.
<p>S10' Steering wheel for arm hand operation (option)</p> 	7473			1	This wheel is attached on top of the leveling head. It can be used to operate the crane in manual mode from the leveling head and to add weights in front in case the head and the camera package are very light.
<p>S10' Overnight cover (option)</p> 	7459			1	It protects your Scorpio 10' without the necessity of removing weights, head or camera. Very easy to install.

- The numbers between brackets means those are extra or spares included with the arm.

2.8.2 DOLLY ACCESSORIES

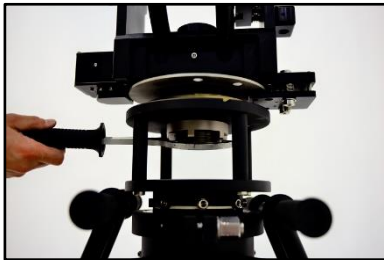
Component	Ref.	Qty.	Description
S10'/S17'/S23'L Dolly parts	7446 7450 7454 7441 7443	2 4 4 1 4	S10' Steering handle for dolly. S10' Screw with knob for travelling wheels. S10' Wheel for dolly S10' Telescopic column S10' Column tensors
S10'/S17'/S23'L Dolly Hardware & spares	7447 7448 7453 7451 7442 7444 7445	2 (1) 2 (1) 4 (1) 4 (2) 4 (2) 8 (2) 6 (2)	S10' Screw to fix steering bar DIN 912 M10x30mm. S10' Holder pin to lock steering D10x40mm. S10' Locking pin for leveling jack D8x60mm. S10' Screw for articulated arm on dolly DIN912 M12x160mm. S10' Nut and washer to fix column DIN6330 M16 DIN 125 M16 S10' Holder pin for column tensor D10x25mm S10' Screw to fix column to dolly DIN912 M10x25mm
S10'/S17'/S23'L Dolly Set of tools (7463)	0070 0089 0075	1 1 1	1/2" Ratchet wrench 24mm Socket 1/2' Drill adaptor
Set of pneumatic wheels	7474	4	Pneumatic wheels for outside the studios.
S10'/S17'/S23'L Leveling Jack	7452	4	Used to lift and level the dolly.
S10'/S17'/S23'L Travelling wheels	7449	4	Travelling wheels for tracks.
S10'/S17'/S23'L Weights basket on dolly	7462	2	This weights basket is attached to the dolly and can be used to transport counterweights with the dolly. There is an attachment for the leveling jacks if they are not mounted.

- The numbers between brackets means those are extra or spares included with the arm.

3 SET-UP

The Scorpio light cranes series are very versatile cranes that can be used in different configurations (*Manual mode, without dolly, over slung, with fluid heads...*). In this chapter it is described how to prepare the crane in different configurations.

3.1 ASSAMBLE THE ARM (*IF NEEDED*)



03.01 Locking the fulcrum.

The Scorpio light cranes arm can be mounted in different supports. The Mitchel mount on the base of the fulcrum can be attached to any support capable of holding the weight of the arm fully loaded (*It can be verified in the technical info chapter*) with a Mitchel mount adaptor on it.

To tight the nut, use the Mitchel mount tool once the fulcrum is on the support with the keyway aligned.



03.02 Introducing the arm.



03.03 Knobs to lock the arm.

With the fulcrum attached, mount the arm on top of the fulcrum by sliding it inside from the top. There is only one position to introduce the arm into the fulcrum. This position is with the brakes on the left side of the arm. Once the arm is inside the fulcrum, lock it using the knobs (*fig.03.03*) and use straps on both sides of the crane to prevent the arm to fall.



03.04 Introducing the H.C. bracket.



03.05 Introducing the CW support.

Once the arm is introduced, mount both sidebars remembering to introduce the Hand command bracket in the operators' side prior attaching the sidebar. The next part to mount is the counterweights support on top of the arm and tight it with the nuts (*fig.03.05*).

3.2 START-UP

The first thing to do is to ensure that the crane will have a stable power source to perform. The power requirements for the crane are detailed in the technical specifications(30V/40A). Batteries can be used always as long as they meet the specifications.



03.06 Connecting the Power Unit.

To power the system, connect the DC power cable into the power supply and verify in the voltmeter on the EB the voltage arriving at the system. If it is correct, switch the breaker ON and press the start button of the EB. If the securities are not ready (*Hand command connected and/or Emergency STOP released*) the system will not start.

Once the system starts booting, the Leveling head will find the level automatically. After it finds it, the system will expect the physical limits of the arm to be found. The limit buttons will be flashing *on/off* indicating that the magnetic limits need to be found. If the screen is connected the *fig.04.04* will be displayed indicating that the limits of the crane need to be found.

At this point the telescopic arm is ready to be used with limited speed or manually if the standby button is pressed. The leveling head will hold the horizon from now on.

3.3 WORKING MODES

The Scorpio crane offers the possibility to control the arm in different modes: without display, with the portable display or the manual mode.

If the crane is used without display, the buttons in the electronic box can be used to do limited functions of the crane. The limits buttons will limit the movement of the arm where they are pressed. If only one limit is pressed (*for example the extension*), the arm will not pass beyond the point marked by that limit. The arc compensation button will activate the Arc compensation ([4.2.3.4 Arc compensation](#)) but the zero position of the pan axis cannot be set. The damping knob in the Electronic box will control the stopping ramp and the Standby button will activate the manual mode.



03.07 Stand by button.

The manual mode offers the possibility to telescope the arm manually while the leveling head holds the horizon. It can be used as a manual slider with horizon level all the time on the Mitchell mount.

There is an operation steering wheel (*Ref. 7473*) in the accessories kit that can be attached to the leveling head to operate the crane from there.

Note: When using the manual mode, the crane cannot use any of its functions such as limits, motion generator or arc compensator, among others.

If the portable display is attached, all the functions of the crane are available. In the [chapter 4 Control display information](#) it is detailed all the information displayed in the screen and an explanation of all the functions.

3.4 BALANCE

The first thing in order to balance the arm is to use the leveling jacks to level the base of the arm. The level can be checked in the fulcrum part or in the dolly base. Be sure to start leveling from the higher point of the base.



03.08 Remote head on S10'.

Mount the Head in the Mitchell mount and, if possible, mount the whole camera package that will be used. If there is no possibility to get the full camera package with the head at this moment, there will be needed to repeat the next steps in order to balance the crane properly.

To balance the crane there are two steps. Step one is to balance the static part of the crane, as if it is a rigid crane. The second step is to balance the moving part of the crane, the telescoping arm.



03.09 Locking pin for the arm.

Remove the locking pin of the arm and move the arm in order to leave the counterweight carriage in the middle of the Fulcrum (fig. 03.08). There is another locking point to lock the arm in this position. In this position the weights in the counterweight carriage do not affect to the balance of the crane. In this position, check which side of the crane is heavier and add weights in the back-counterweight support to

balance the crane. The straps must be slightly loose, and the tilt brake must be released in order to identify the heavier part easily.

Note: In case the arm is heavier on the back part, the Steering wheel on top of the leveling head can be used to attach weights.



03.10 Arm extended and balanced.

Once the Static Balancing has been achieved, the crane arm can be extended. When the arm becomes front heavy, stop, and add weights in the counterweight carriage until the correct balance is achieved.

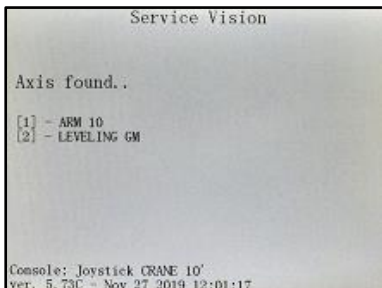
This process is repeated until the arm is at the maximum length and is balanced through its entire length. At the end, when the maximum length has been reached, the smaller weights are used to reach the best balance and the straps can be removed to be more precise on the balance.

Note: Remember to lock the weights with the locking pin or the nut once they are introduced into the support

Now the crane is ready to use all the functions on it.

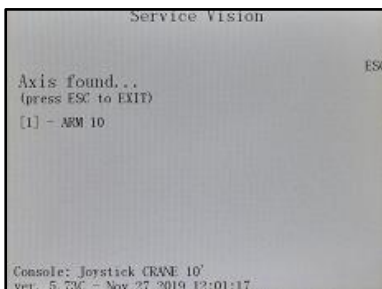
4 CONTROL DISPLAY INFORMATION

The following chapter describes the different screens displayed when starting the Electronic box:



04.01 CCU finds all the servos.

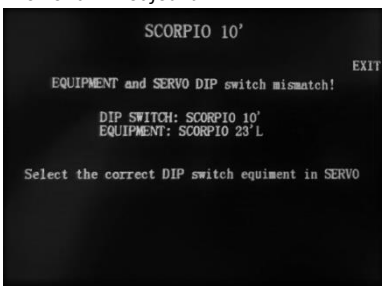
After pressing the START button in the electronic box and if all the securities are ready (*Hand Command, Emergency stop.*) screen 04.01 will appear. It shows to the user that the system is trying to connect with the Servos of the Arm motor and the Leveling Head.



04.01b LH not found.

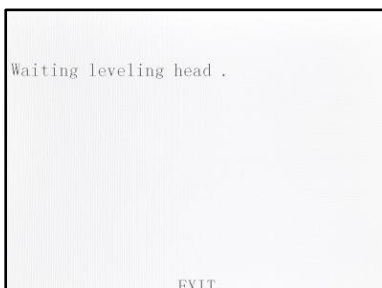
If the Central Control Unit does not find one or both of these axes (*the Leveling head is disconnected for example*), it is possible to press ESC in order to access the rest of the menus. If ESC is pressed, Matrix mode is enabled (see [chapter 8.2 Matrix mode](#)).

Note: In case the electronic box configuration does not match the crane (an electronic box for the S10' is connected in a S23'L crane for example), an error message will appear on the screen (fig.04.02). See the [chapter Replacement of the Electronic box](#) for more information.



04.02 Mismatch between EB and arm.

If the Central Control Unit finds all the axes, the screen 04.03 will automatically appear and show us that the Leveling Head is searching the horizon level set by the factory. Once the horizon has been reached, screen 04.04 will automatically appear.



04.03 LH Searching for level.

While the crane is switched ON, the Leveling Head will correct any change on the level automatically once it finds the horizon level.

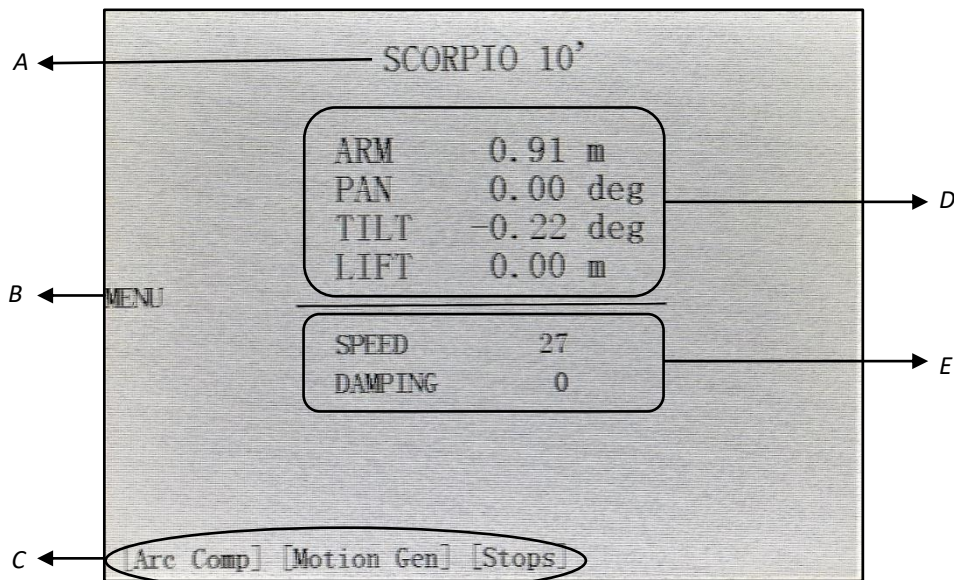


04.04 Finding magnetic limits.

At this point, the crane can be moved but with limited speed and one magnetic limit must be found. The arm has an extended limit and a retracted limit. It does not matter which one, but the system needs to find one to be able to calculate where the Arm is. The crane must be moved using the Hand Commands rocker until one magnetic limit is detected. Once the limit is detected, the arm will stop moving in that direction. Once it is moved on the opposite direction, the limit will stop detecting, the system will acknowledge the position of the arm, and the main screen will be shown.

4.1 MAIN SCREEN

This is the Principal Menu screen. The different features buttons and system information appear in this screen. The following system information appears:



04.05 Main Screen.

A: The model on crane being used, SCORPIO 10' in this case.

B: Opens a dropdown tab with different functions and configurations for the head ([chapter 4.2 Operation menu](#))

C: These are shortcuts to the main functions of the crane (*see each menu independently*). If any of these functions is activated, they will be flashing green.

D: This is the information of the position of the crane such as:

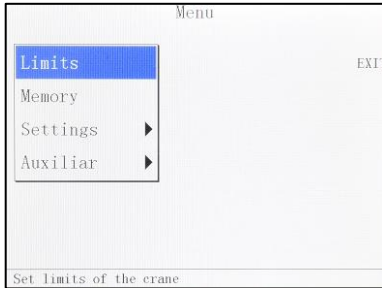
- The length of the crane arm in meters or feet (*from the center of rotation*).
- The PAN axis angle respect to where the Crane Arm was switched on or from the Zero Position when a Pan Reset is done ([see 4.2.3.3 Reset pan menu](#))
- The TILT axis angle respect to the horizon.
- The LIFT is the height of the camera lens and can be adjusted ([see 4.2.3.2 Lift calibration](#)).

E: Displays the Arm Movement Speed from 0% –100%. If the Speed setting is below 5, “Very Slow Speed” is displayed.

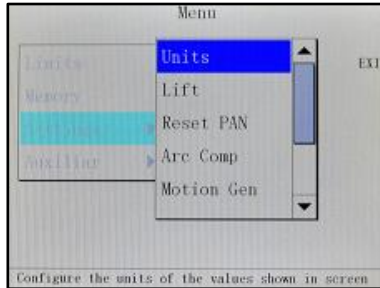
The Damping level goes from 0, very hard to 100, very soft. This is how soft or hard the Crane Arm slows down when stopping. This setting affects the Programmable Limits, the final Arm Limit ramps and the stop at any point where the operator stops telescoping.

4.2 OPERATION MENU

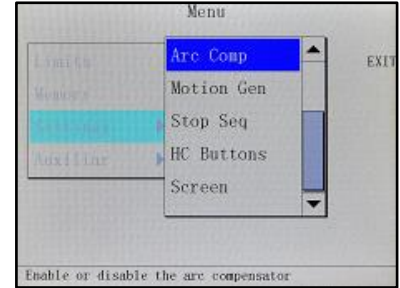
These are all the menus available through the MENU button. Each menu is described below.



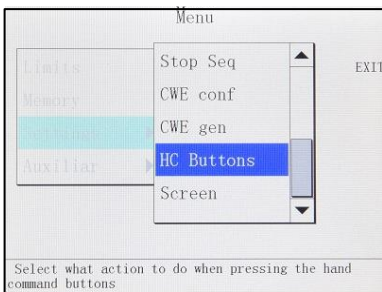
04.06 Dropdown Menu.



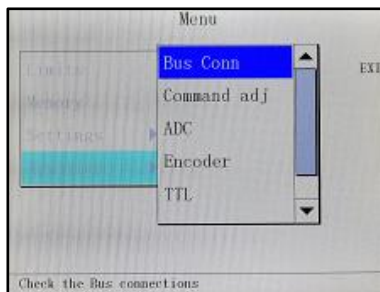
04.07 Dropdown Menu Settings 1.



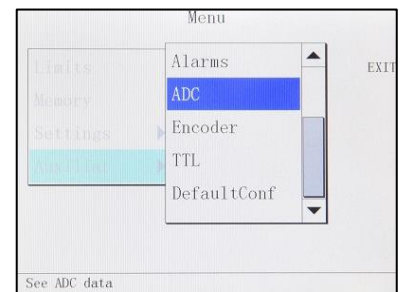
04.08 Dropdown Menu Settings 2.



04.09 Dropdown Menu Settings 3.

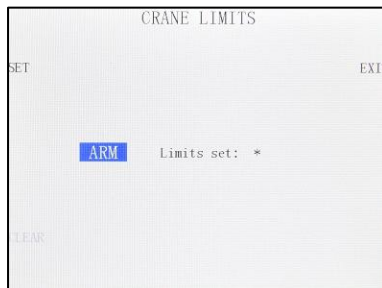


04.10 Dropdown Menu Auxiliary 1.



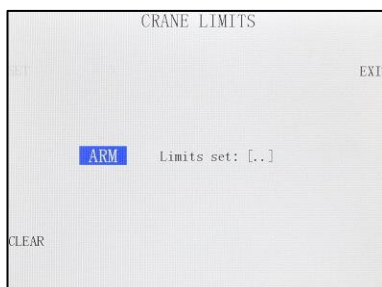
04.11 Dropdown Menu Auxiliary 2.

4.2.1 LIMITS



04.12 Limits menu without limits.

This menu sets limits on the movement of the arm. To use it, move the arm to the desired length and press SET (fig. 04.12). One bracket “[”, will appear indicating that the point has been saved. Now move the arm to the other desired position and press SET again. Another bracket will appear “[.]”, indicating that both limits are activated. The arm will never telescope beyond those points.



04.13 Limits menu with limits activated.

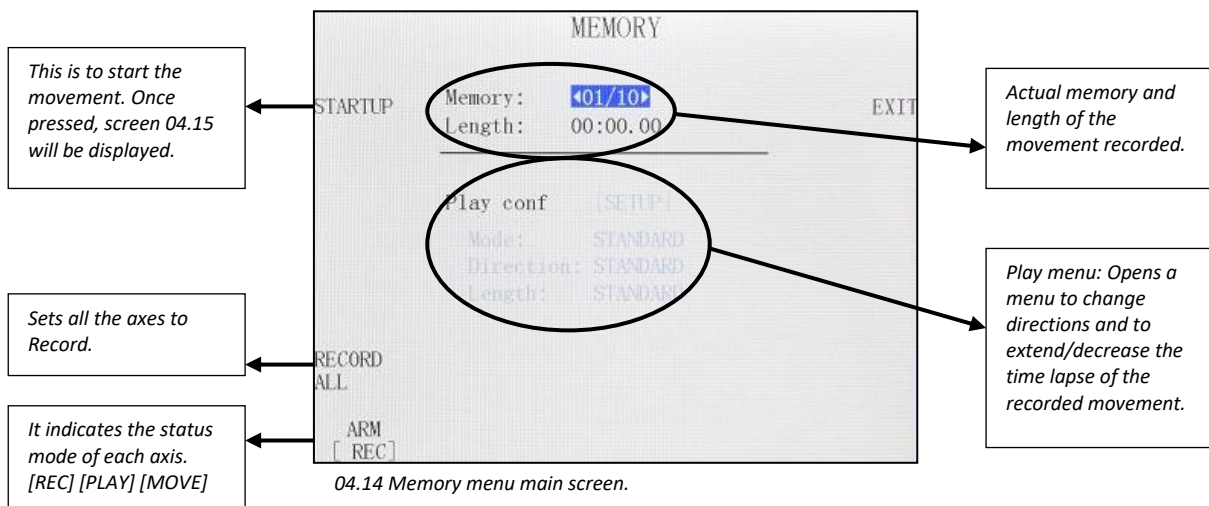
To erase those limits, press the CLEAR button and both limits will be erased.

Note: If the crane is switched off, any limit recorded will be erased.

4.2.2 MEMORIES

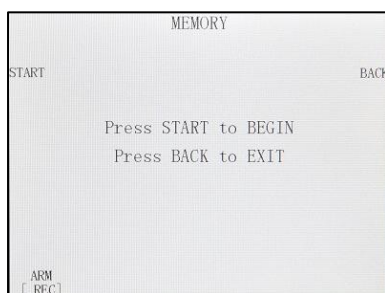
The Memory menu allow to record movements of the arm. The recorded movement can be reproduced and modified afterwards. It also allows to change the direction and the time lapse of the recorded movement.

The system records the memory directly to an SD card located inside the electronic box. In case there is no SD card, the system will not allow you to go further on the memory menu.



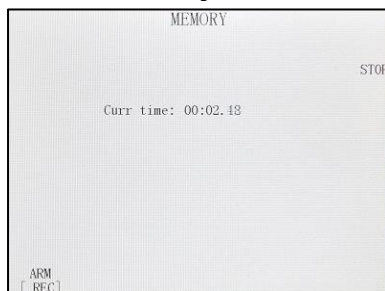
4.2.2.1 RECORD A MOVEMENT

There are 10 slots of memories. To record a movement, select which of those 10 memories will be recorded. Then, on the bottom left corner, be sure that the ARM axis is on REC. RECORD ALL button can be pressed to change all the axes states to REC.



04.15 Start recording screen.

Now press STARTUP and the screen will change to fig. 04.15. While this is screen is being displayed, no movement will be recorded, allowing the user to relocate the crane at the starting position for its movement. The START button triggers the memory and a time counter will appear (fig. 04.16) indicating that the memory is being recorded.

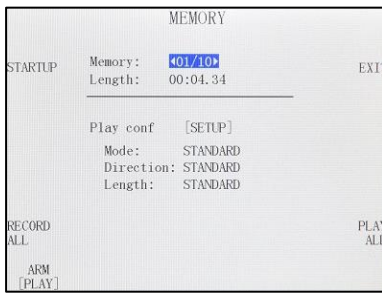


04.16 Recording memory.

Once the take is finished, the STOP button finishes recording the memory.

Note: The maximum length of recording each memory can be 1 hour.

4.2.2.2 PLAYBACK A MOVEMENT



04.17 Memory recorded screen.

Once there is a memory recorded, the system allows different playing configurations to play/reproduce a recorded movement.

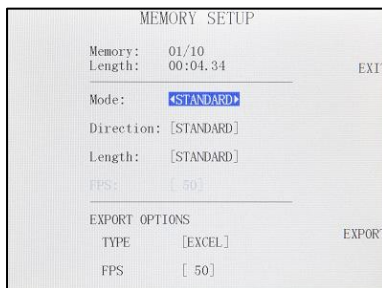
To playback a movement as it was recorded, change the status mode of the ARM axis to [PLAY] or press the PLAY ALL button to change all the axes states to play.

Then press the STARTUP button and the crane will automatically go to the beginning position of the recorded movement (this action is called HOMING). Now screen 04.15 is displayed again. Press the START button in the touchscreen and the same movement recorded will be reproduced.

Note: The recorded movement can be stopped at any time by pressing the STOP button in the display or the GREEN button in the Hand Command while the memory is being played.

4.2.2.3 CONFIGURE AN EXISTING MOVEMENT

By pressing the [SETUP] button of an existing memory the user can access to modify that memory.



04.18 SETUP of a memory.

MODE:

- Standard: Regular playback mode.
- Stop Motion: It allows to playback the memory frame by frame. The FPS option sets how many FPS the user wants.

DIRECTION:

- Normal: Regular playback mode.
- Reverse: The playback starts in the end of the movement and ends in the beginning position of the recorded movement.

LENGTH:

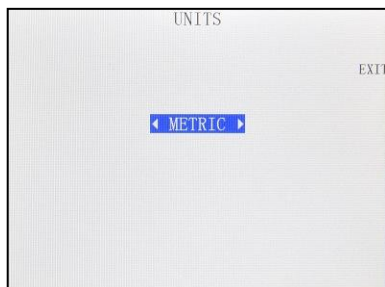
This is the length of the movement; it can be multiplied by 2 as many times as needed to make it slower.

EXPORT OPTIONS: with the EXPORT button a file is generated in the SD card. In this submenu it is possible to choose the type of file (ASCII or EXCEL) and how many FPS will have the exported file.

Note: the memories will remain in the SD card once recorded even if the crane is switched off. The file in the SD card can be used in a different crane of the same model to reproduce the same movement.

4.2.3 SETTINGS MENU

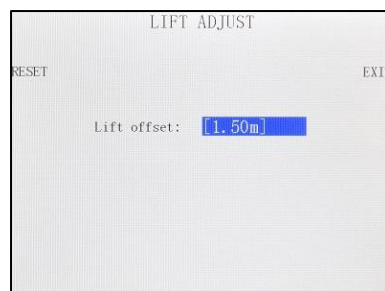
4.2.3.1 UNITS



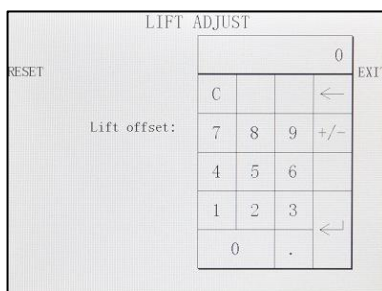
04.19 Units Menu.

In this menu is possible to select how the distance information is displayed: Metric system or Imperial system.

4.2.3.2 LIFT



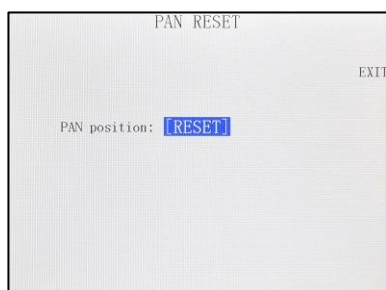
04.20 Lift Adjust menu.



04.21 Lift adjust panel.

To introduce a lift offset, measure the lens height without moving the arm. Introduce that distance using the keypad and when the arm moves it will calculate the height change of the lens and it will display in the main screen.

4.2.3.3 RESET PAN



04.22 Pan Reset menu.

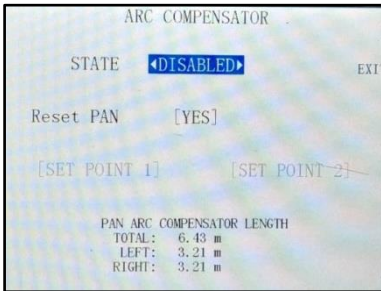
The reset pan feature is used to set the 0° in the actual position of the arm. If the 0 position of the arm is not done, the position that the arm had when the system was started will be taken as the 0° position.

Note: The 0 position of the Pan axis is used for different features such as Arc Comp, Motion Gen, or the Integration with the Scorpio Heads. Please physically mark the 0 position before using these features to save it in case of a power cut.

Note 2: If the crane is Integrated with the Scorpio Heads for a tracking movement, the change of the 0 position of the crane will affect to the position of the Scorpio Head.

4.2.3.4 ARC COMPENSATION

The Arc Compensator feature can be activated by pressing the **GREEN** button in the Hand Command, by pressing the [Arc Comp] button in the main screen or by changing the STATE in this screen (fig. 04.24).



04.24 Arc compensator menu.

This feature compensates for the arc generated when both the Pan and/or Tilt are moved. The compensation is automatic, works in any arm position and does not affect the normal operation of the arm. The arm will telescope by itself correcting the arc generated by the Pan and/or Tilt movement but the user can still control it. There might be a small error due to the mechanics tolerances.

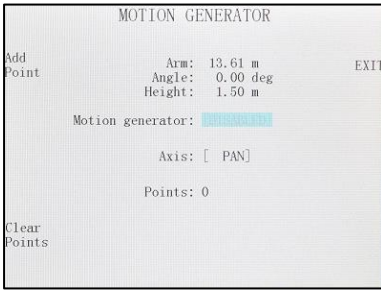
The Tilt compensation will always be vertical, but the Pan compensation is respecting the 0° position in PAN axis. If the Reset PAN of this menu is in [YES], every time the Arc Comp feature is activated it will reset the 0° position in the PAN axis of the arm and it will set it in the actual position of the arm. It is also possible to set this 0° PAN position using two points: Move the arm to one end of the desired horizontal correction and set point 1. Move the arm to the other end of the desired horizontal correction and set point 2. The system will change the 0° PAN position in order to correct on the line marked by those two points. The Pan arc compensation length will be displayed on this screen to inform the user where is the end of the pan compensation. The maximum correction for Pan is +-80 degrees from 0° position.

Note: This feature cannot be used with the Motion Generator feature.

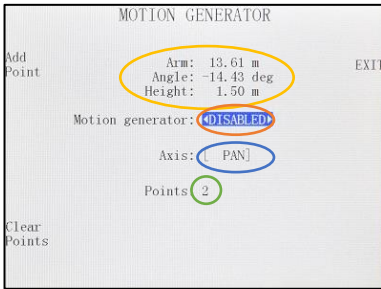
Note 2: There are limitations on the use of this feature. If the operator swings the arm too fast, the motor may not be fast enough to follow the arm.

Note 3: If the Pan 0° position is set using two points, the reset PAN must be in NO, otherwise every time it is activated the PAN 0° position will be reset and changed.

4.2.3.5 MOTION GENERATOR

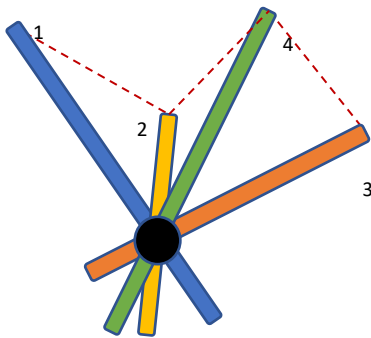


04.24 Motion generator without points.



04.25 Motion generator with points.

- A – Information of the actual position
- B – State of the Motion gen
- C – Working axis
- D – Number of points recorded



04.26 Movement of the motion gen.

The Motion Generator feature allows the user to set some key frames of the extension of the arm respect to the degrees of one of the axes Pan **OR** Tilt. This means that while the user swings the crane in one axis (*Pan or Tilt*) the crane will automatically retract or extend in order to pass through these extension points in the desired degrees. The operator will not have control of the extension of the arm.

To start using it, select the working axis (*PAN or TILT*) by pressing the axis name. The Pan or Tilt encoder is the one who will generate the arm movement. If the Pan axis is selected, set the Tilt the arm to the horizontal position and lock the Tilt axis. If working in the Tilt axis, lock the position of the Pan axis using the Pan brake.

Once the axis has been selected, move the extension of the arm in one desired keyframe for a certain degree and press the Add Point button. Now change the degrees in that axis and adjust a new extension for the arm to set another point. Repeat this procedure to save as many points as desired.

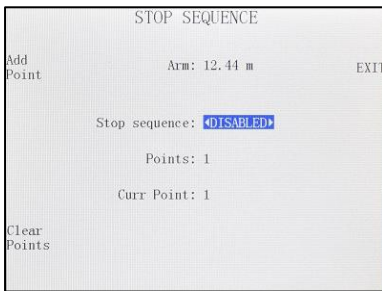
Once all the points are recorded, enable the Motion Gen. Now the extension of the arm is automatically moved by the system while the arm is being moved in order to pass through the key points. The operator cannot control the arm while the Motion generator is engaged.

Note: The minimum degrees between points are 5 degrees. If the point introduced has less difference with the previous, it will not be recorded.

Note 2: The motion generator on the pan axis works respect the zero position. See reset pan for more information.

Note 3: The order of the points does not affect the movement of the arm. In fig. 04.26 there are 4 points (recorded from 1 to 4) in the pan axis and the line that the arm will follow to reach those points.

4.2.3.6 STOP SEQUENCE



04.27 Stop Sequence menu.

This feature can be used to set different stop points for the telescopic movement.

To start using it, extend the arm to the first desired stopping point and press the Add Point button. Now is possible to enable the stop sequence.

Move the arm to another extension point if desired and press Add Point again. This process can be repeated as many times as needed.

Once all the desired stops are added, Enable the Stop sequence feature and the Current point will be set in 1. Now if the arm is extended or retracted it will stop in the current point of the extension. To change to the next point, press the **GREEN** button on the hand command or press the next point button in the Stop sequence screen. The order the user sets the points is the order that the system will follow.

4.2.3.7 HAND COMMAND (H.C.) BUTTONS

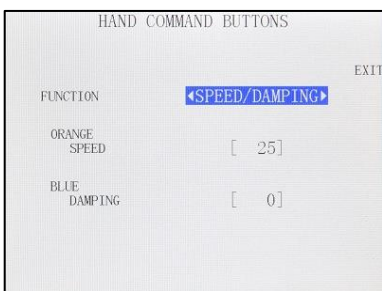
The **GREEN** button is the main action button, below is detailed the different functions of this button depending on the screen shown in the display.

GREEN button functions on different screens	Main menu screen	Memories screen	CWE Gen Screen**	Motion Gen screen	Stop sequence screen
Short pressed	ON/OFF the Arc compensator*	Start/Stop memories	Add new point	Add new point	Add new point
Press & Hold.	While holding the button, the rocker will move the counterweights in any screen**				

*If the Stop Sequence mode is Enabled, the short press increases current stop point number.

** FUNCTION NOT AVAILABLE IN THE SCORPIO LIGHT CRANES

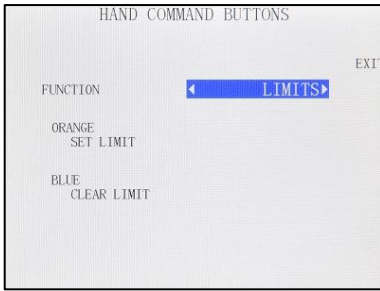
The ORANGE & BLUE buttons can be configured in different modes as shown:



04.28 Hand command Speed/Damping.

SPEED/DAMPING MODE: Configures the **ORANGE** button to set a Speed value and the **BLUE** button to set a Damping value when they are pressed. If any of these buttons are pressed, in the main screen the speed and the damping will change to these presets and a purple background will be displayed.

If the buttons are pressed & hold, the preset of this screen will be set as long as the button is being hold.



04.29 Hand command Limits.

LIMITS: Configures the **ORANGE** button to Set a limit at the current point when pressed. Once one limit is set, it is still not decided if is the extended or the retracted limit. When the crane is moved from that point, the type of limit is defined, and another limit can be set. The LED on the E.B. (*if present*) or the brackets around the word "Limits" can be seen in the main screen once they are set.

The **BLUE** button clears the nearest limit when pressed.

REST OF THE MODES: The rest of modes changes the function of the orange button on the main screen accordingly to the next table:

ORANGE button functions on different screens:	Main menu screen	CWE Gen screen	Motion Gen screen	Stop sequence screen
CWE GEN MODE**	ON/OFF CWE GEN	ON/OFF CWE GEN	ON/OFF MOTION GEN	ON/OFF STOP SEQ.
MOTION GEN MODE	ON/OFF MOTION GEN	ON/OFF CWE GEN	ON/OFF MOTION GEN	ON/OFF STOP SEQ
STOPS MODE	ON/OFF STOP SEQ	ON/OFF CWE GEN	ON/OFF MOTION GEN	ON/OFF STOP SEQ

*In all cases it is expected a short press of the button.

**FUNCTION NOT AVAILABLE IN THE SCORPIO LIGHT CRANES

The **BLUE** button in all cases will show the main screen when pressed.

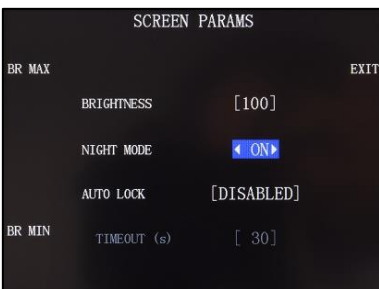
4.2.3.8 SCREEN



04.30 Screen menu.

Changes the brightness from the display. Also is possible to enable the night mode (black screen with less backlight) or set an auto lock for the screen, a function that after a timeout locks the screen to prevent miss clicking on it. If the screen is locked, on the bottom right corner will inform the user that the screen is locked.

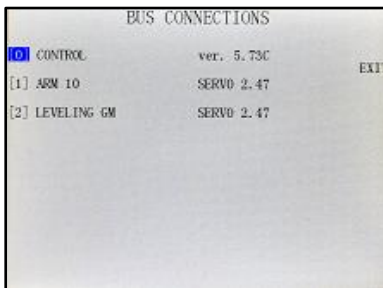
To unlock the screen press in any point of the display and the system will ask if the user wants to unlock the screen.



04.31 Night mode ON.

4.2.4 AUXILIARY

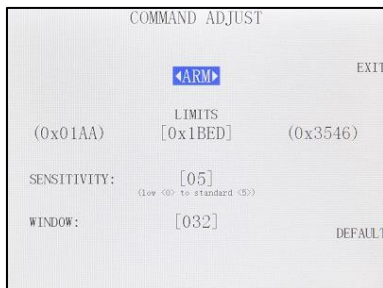
4.2.4.1 BUS CONNECTIONS



04.32 Bus connections.

In this menu everything connected to the communication line will be displayed. Also, it is possible to see the Software version for each axis and, if the number of an axis is pressed, a screen will display more information referred to that axis.

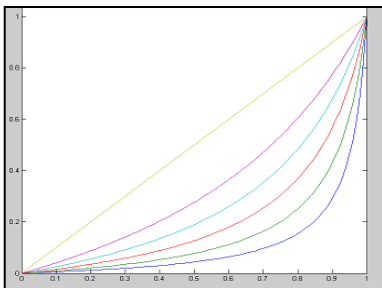
4.2.4.2 COMMAND ADJUST



04.33 Command Adjust screen.

It calibrates the cursor of the Hand Command. To calibrate it, press the limits numbers in the middle of the screen (*fig.04.33*).

Once the calibration screen appears, move the cursor to both limits and then press OK. Now the range of movement of the cursor is introduced to the system. This needs to be done in case the crane moves faster in one direction than the other.



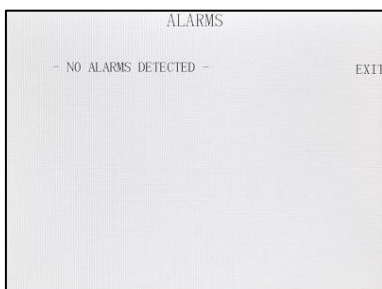
04.34 Relations of sensitivity.

The SENSITIVITY parameter changes the relation between the cursor from the Hand Command and the speed of the crane. It goes from a lineal relation (5) to an exponential relation by reducing this parameter until 0 (*fig.04.34*). The more is reduced, the more exponential the relation.

WINDOW is the range of the potentiometer where it can be moved, and the system will not make any movement on the crane (*also known as dead band*).

Note: The DEFAULT button sets back the factory settings.

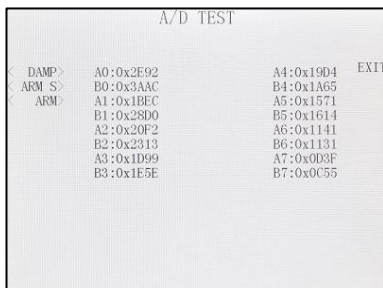
4.2.4.3 ALARMS



04.35 Alarms.

The SCORPIO LIGHT CRANES recognizes a series of different alarms. In case the temperature of the motor is too high for example, it will be displayed in this screen.

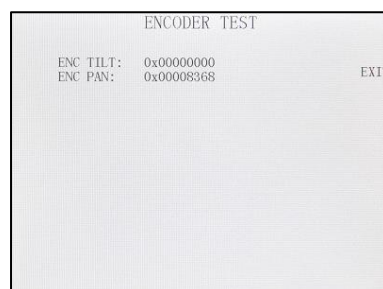
4.2.4.4 ADC TEST



04.36 ADC Test.

Displays the readings for the Analog/Digital converters. This screen is for troubleshooting, in case one potentiometer does not work, here is possible to see if the CCU have a reading for that potentiometer.

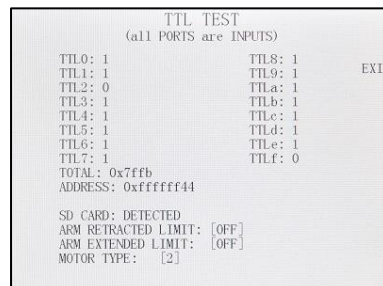
4.2.4.5 ENCODERS



04.37 Encoders.

Displays the readings of the encoders connected to the CCU. In case the encoder signal does not change when the controller is moved, there is a problem with that controller.

4.2.4.6 TTL

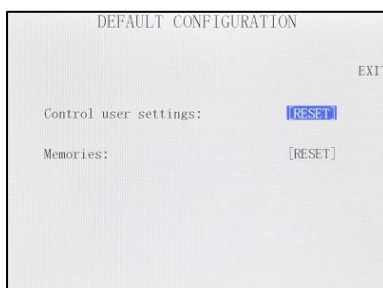


04.38 TTL Readings.

Displays the digital inputs (buttons, selectors...). In case one button is pressed or one controller is connected a change in this screen will be seen.

Also shows if one the magnetic limits is detecting or if the SD card is connected.

4.2.4.7 DEFAULT CONFIGURATION



04.39 Default Config.

In this is screen is possible to reset the memories and set the user settings (*Damping, CWE points, L. Head configuration...*) back to the factory settings.

5 SECURITIES & FACTORY RECOMENDATIONS

Before delivering any product made by Servicevision, the product is completely assembled to detect and ensure there will be no problem in the assembly process once it has been delivered to the final customer and to verify the functioning of the systems.

All the parts and components designed by Servicevision (*free of toxic, dangerous or hazard materials*), has eliminated any sharp edges, avoiding the possibility of cutting.

5.1 BASIC SAFETY INFORMATION

There are several points to consider in order to operate the Scorpio cranes without any risk or danger:

- Crane technicians and operators must have received the proper formation through the training given by Servicevision.
- Scorpio crane operators must wear the individual protection: helmet, protection working boot and protection gloves.
- It is **MANDATORY** having perfectly balanced and the counterweights locked and secured **BEFORE** operating the Scorpio cranes.
- **DO NEVER** use the Scorpio cranes under weather conditions such as electrical storms since the system might be a spotlight for electrical discharge.
- **DO NOT** manipulate any component of the arm while the system is engaged, there is a risk of entrapment in case someone else moves the arm from the hand unit.
- **NO** person can be inside the arm turn radius. In case of the presence of spectators or public, a delimited area will be defined visually, and a verbal security announcement must be given, warning about the existing hazard.
- In case there is no operator or technician in the area, the Scorpio cranes **MUST BE COMPLETELY DISCONNECTED** and with the two security straps on and the arm locked and the safety pin blocking the arm.
- Consider that being a predominantly metallic element, there is a risk of burns if heat sources in proximity, such as high-power illumination spotlights or other similar devices.

It is essential to have the arm correctly counter balanced for the correct using of the Scorpio cranes. Otherwise, the movement of the arm will be uncontrollable by the operator, with the real danger of seriously injuring the personnel working or near the arm.

5.2 MALFUNCTION RISKS

Next there is a list of events related to the crane and the possible danger associated to the malfunction of each part. In the event any of the following occurs, contact Servicevision for the procedure to follow.

Event on the crane	Risk associated
Working with the crane unbalanced	There is a risk of not being able to control the movement of the crane. Balance the crane before operating it.
The steel side cables are broken	There will be no control of the next section, it will be detached from the system and therefore uncontrollable. The crane cannot work until the cables have been replaced.
The main section belt moving the first section breaks	If the crane is in the horizontal position no risk will happen. If the crane is tilted, even slightly, the counterweights trolley will move freely, and the balance of the crane will be lost. The crane cannot work until the belt has been replaced.
Moving the telescopic arm with something blocking it	There is a risk to burn the motor or damage some mechanical component. Remove anything blocking the telescopic section before operating the crane.
One guiding wheel breaks or is too tight	The rail can be damage and the movement of the crane is not smooth. Replace/readjust the wheel.
The arm motor belt is broken	If the crane is in the horizontal position no risk will happen. If the crane is tilted and not balanced, the CWE trolley will move freely, and the balance of the crane will be lost. The crane cannot work until the belt has been replaced.
Pan or Tilt brake pads loose	The crane will be moved freely by the wind and it can hit anything in the surroundings.
Electronic box breaks	The crane will stop but there are no risks associated. Replace the electronic Box to operate the crane again.
Leveling Head breaks	There will be no correction of the horizon and the balance of the arm when it is tilted will be lost. Replace the leveling head.
Working in Electrical storm conditions (lighting and thunderstorms)	There is the risk of serious injury and death by electrocution or burns for the operators/technicians or any personnel near the crane.
Wind Speed	The consequences of ignoring the maximum wind speeds permitted to operate each Scorpio crane will lead into overturning/capsize. With a REAL RISK of injuring crew and personnel around the camera car.

5.3 POTENTIAL DANGERS FOR THE USER

There are mechanical dangers to behold, but if the crane is manipulated with all protections, equipment covers and instructions received under both the user's manual and the training given by Servicevision's authorized trainee, it should be no danger.

Noteworthy, the operators must always know the performance limits of the machine, thus watching that no person entering the physical space of operation. In locations where there is presence of public, it also must perform a hazard warning verbally or implement a security fence to prevent any approach.

Operators will also be responsible for monitoring during the operation; no person may come into contact with the crane:

- All protection covers must be mounted for operation.
- The protection bars need to be mounted ALL THE TIME, only for doing certain maintenances they can be removed.
- Table of potential mechanical hazards associated in case the instructions are not followed is shown below.

5.3.1.1 MECHANICAL HAZARDS:

These are the mechanical hazards that may arise in the case that the conditions and explanations given by Servicevision training personnel are not followed.

Mechanical Hazards	Associated to the Scorpio cranes
Flattening/Crushing	Yes
Shearing	Yes
Cutting & Sectioning	Yes
Hitch	Yes
Dragging & Entrapment	Yes
Impact	Yes
Piercing & Puncture	No
Friction or Abrasion	Yes
Pressurized fluid injection	No

5.3.1.2 ELECTRICAL HAZARDS:

There is a risk of electrical hazard in case the following instructions are not followed:

- Take caution when connecting the power, electrical hazard.
- Do not use cables without an earth ground connected to the system.

5.4 PROTECTION SYSTEMS

5.4.1 PROTECTION AGAINST OVERLOADS



05.01 Circuit breaker.

The Scorpio cranes have a cutting element against electrical overloads; the circuit breaker is located at the power input. It is a protection against electrical overload (and shortcuts) 20 A caliber and curve C.

5.4.2 ENCODER PROTECTION SYSTEM

In what entails to the arm movement, there is a protection system that will disconnect the motor if the system detects a malfunction. In the event something gets stuck in the movement of the arm (*or something is hit*), the system will display an alarm in the main screen since it detects inconsistent information regarding the position of the arm. It will also happen if something blocks the movement of the arm.

5.4.3 SECURITY CIRCUIT BOARD



05.02 Security circuit board.

There is a board inside the electronic box that controls all the components to start the crane such as: The start button, the red emergency button, and the hand command. If any of the three components is not ready the crane will not be able to start.

5.4.4 PROTECTION BARS AND COVERS



The protection bars mark the area of movement of the Telescopic counterweights, therefore **NEVER** get in between the protection bars and the crane, there is a high risk of squashing if the crane moves.

The covers protect any moving component inside the telescopic arm therefore **NEVER** can be removed while the crane is moving, there is a high risk of squashing if the crane moves.

5.5 SYSTEM SHUTDOWN



05.03 Emergency STOP.

In case of necessity, there is an emergency stop button in the Electronic box and a red button in the hand command. This emergency stop buttons will shut down all the system immediately.

These safety features cannot be reprogrammed by the user; security routines **CANNOT** be modified.



05.04 Hand command stop button.

Note: If the system shuts down while the arm is expanding or retracting, the inertia of the arm will make that the arm continues with the movement until it stops by friction.

6 SERVICE & MAINTENANCE

The Scorpio cranes must be inspected periodically since the delivery date. The inspections must be done by qualified personnel.

Each inspection will determinate the conditions of the equipment, and the parts or components that need repair or replacement.

In case the user is not doing these inspections or is not following the recommendations of the technical personnel of Servicevision, Servicevision will not be responsible of any damage generate by the crane.

6.1 MAINTENANCE REQUIREMENTS



Any maintenance must be done only by personnel trained by Servicevision. Servicevision will provide the certificate as Maintenance technician.

The Maintenance technician will decide how often and the works to do depending on the shooting conditions on the previous shooting and the reports received from the operators and the technicians on location.

6.2 GENERAL MAINTENANCE

For a proper and correct maintenance, the Scorpio cranes must always be revised before and after every shooting. The parts to be checked or changed will be under the maintenance technician judgement. As well as the parts to be cleaned or lubricated since the conditions under the crane has been exposed in the previous days can be different every time.

Before every shooting there are some parts to be checked or cleaned (*Such as the status of the belts or the rails under the telescopic sections*). It is under the maintenance technician's judgement to check the different parts of the crane. It will also depend on how many times the crane work during this period of time and under which conditions.

Note: Before any arm manipulation, the crane must be disconnected from the power source and strapped into the dolly unless it is specified.

Note: Remember that if the crane is started with the sections being locked by a strap or a bar, the motor might get damaged or burned.

The situations where the crane had been exposed to humid/wet environments such as rain, high humidity areas, rain effect shootings, shooting near water areas such rivers or sea, etc. requires following the next steps:

- General drying of all the components of the crane. Open the covers to be able to reach the inside parts of the arm.
- Cleaning of all the mechanical components for the telescopic arm using a degreaser and a rag, mainly the wheel guides, the steel wheels, and any other component subject to friction.
- In case of salty environments such as beaches or long periods near the sea, all the procedure must be done deeply and previously washed with fresh water the non-electrical components.
- Lubricate the aluminum wheels in case the existing lubricant is dirty or inexistent.
- Open the covers for the electronic box and the leveling head to let dry the possible moisture inside these components.
- Clean the electronic connectors with contact cleaner, let it dry before connecting the crane.

The situation in which the crane was exposed to environments with suspended particles, such as deserts, beaches, mountainous areas, or places with special effects (*paper, glitter, environmental smoke, etc...*), the procedure and the steps to follow are:

- Expulsion/blowing all the particles with compressed air after opening all the covers.
- Cleaning of all the mechanical components, mainly the areas of contact between wheels and the guides with degreaser.
- In case of salty environments such as beaches or long periods near the sea, all the procedure must be done deeply and previously washed with fresh water.
- Lubricate the aluminum wheels in case the existing lubricant is dirty or inexistent.

Normal shooting situation involving crashes, emergency full stops, sudden side tackles, etc. requires the following steps:

- Check that the contacts between guides and wheels are in good condition without particles that might interfere with the correct functioning of the arm.
- Check the main belt of the crane to see if it is in good conditions, with the proper tension and without frayed parts.
- Check the tension of the screws tightening the different parts of the crane: dolly-column, column-fulcrum, fulcrum-arm, arm-leveling head, and arm-electronic box.
- Remove the carbon fiber covers and visually inspect the guides are in good condition (*without any broken wheels, with hits or any damage in the guides*) clean of any particles that might interfere with the correct functioning of the crane.

6.3 MAINTENANCES

6.3.1 ARM RAILS AND ROLLERS

The outside telescopic rails and rollers are along all the telescopic sections of the arm. To clean them, extend the arm completely (*balanced*) and use a rag with degreaser applied on it to clean all the rails. Use the same rag to clean the rollers that move with these rails.



06.01 Outside rollers and rails.

Once the rail is clean, apply just a little bit of lubricant for motorcycles chains in a rag and pass it along the whole rails. If too much is applied, it will attract dust and small particles (*is better to keep it dry and clean than too much oily*).

Inside every section there are rollers and rails to move the telescopic sections. To clean them, open all the covers of the crane in order to have access to these rails and then apply degreaser in a rag and clean all the dirty grease along the rails.

Once the rails are clean, use a brush to apply a small amount of regular grease along the top rails of the main and the first section.

6.3.2 FIRST SECTION ARM BELT



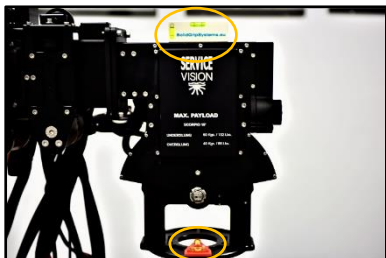
06.02 Tension screws.

The belt that transmits the movement to the first section can be tightened by screwing clockwise the two screws at the end of the front pulley. The tension needs to be applied on both screws at the same time to prevent the pulley to work sideways.

It is recommended to tight this belt in the horizontal position and with the crane halfway extended. After tightening it, extend and retract the arm to verify the tension of the belt.

6.3.3 LEVELING HEAD HORIZON ADJUST

The leveling head normally works in the AUTO mode to level the horizon automatically as the crane tilts. In the MANUAL mode, the LH can hold the horizon manually modified (*through the front knob*) but this manual level has to be set every time the crane starts since it will NOT be saved into the system.



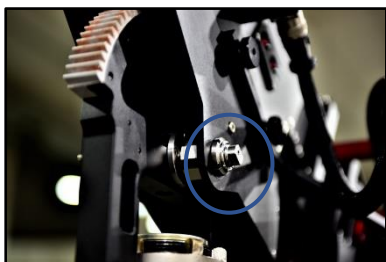
06.03 L.H. Horizon adjust using levels.

To adjust the AUTO horizon level, press down the L.H. Adjust switch and start the crane with the leveling head and the Mitchell mount leveled. Hold it down until the LEDs of the L.H. flash in static green; then the new horizon has been set. It needs to be adjusted in underslung and over slung since they might be different.

Note: When the crane is Switched OFF you can always move the LH manually through the front knob. When the crane is ON, it is NOT possible to manually move it.

6.3.4 LEVELING HEAD MECHANICAL ADJUST

In the event that the half-moon gear from the Leveling Head gets mechanical play between the endless screw on top of it, it is possible to adjust it.



06.04 eccentric axis from the L.H.

On both sides of the leveling head there are eccentric axes tightened with KM nuts. At the end of the side shafts (*fig.06.04*), it is marked the center of the axis to know how tight the half-moon gear is.

To approach the half-moon gear to the endless screw, loose the KM nuts on both sides of the Leveling Head. With the KM loose, use two fix 34mm wrenches to move both eccentric axes clockwise or counterclockwise as needed (*fig.06.05*).



06.05 Adjusting the eccentric axis.

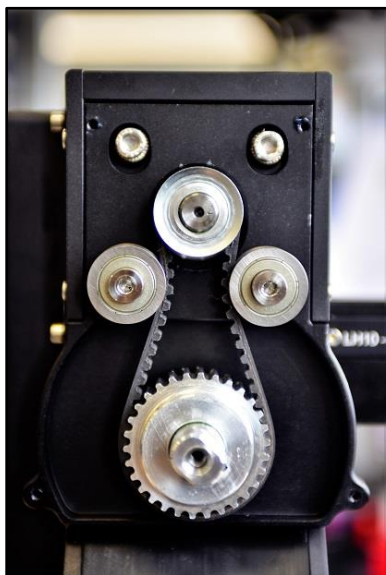
Once there is not mechanical play, tight the KM nuts again and verify manually that it is easy to move the knob at the end of the Leveling Head without mechanical play.

Note: If the half-moon gear is too tight against the endless screw there is a risk to burn the motor of the leveling head.

6.4 SERVICES

6.4.1 BELTS

6.4.1.1 LH BELT

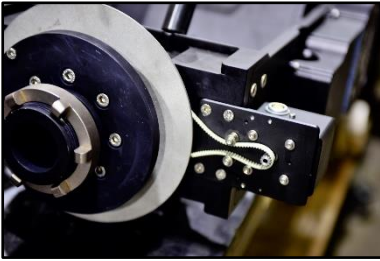


06.06 Motor belt for the L.H.

Under the front cover of the Leveling Head there is access to the motor shaft and the belt of the LH. To tight the belt, loose the 4 screws holding the motor and push the motor up to apply tension to the belt. To remove it, lose the 4 screws and the tension of the belt will be released.

- Commercial reference for LH motor belt: RPP5 265

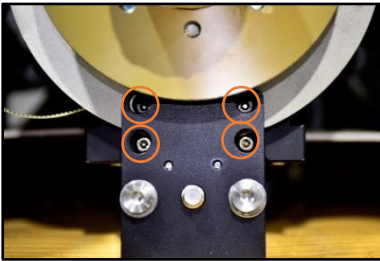
6.4.1.2 ENCODER BELTS



06.07 Pan encoder belt.

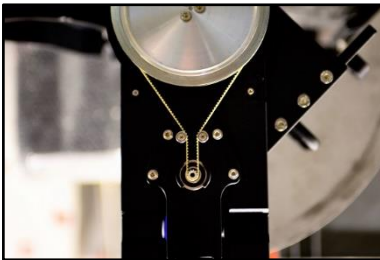
The Pan encoder is in the right side of the fulcrum and the color of the connector for this encoder is grey. The pan belt is tight using the encoder itself as a tensor. There are 4 slotted holes in the encoder to slide it in or out and apply more or less tension. Those screws are accessible once the bottom cover is removed (*fig.06.07*).

To remove the pan encoder belt, the pan brake pad needs to be dismounted. To do so, the brake disk can be moved in a position where there is access to the screws of the brake pad (*fig.06.08*). Once the disk has been removed, the belt can be changed.



06.08 Pan brake bottom view.

The tilt encoder is located also in the right side of the fulcrum. The color of the encoder connector is blue and to have access to the encoder belt the cover needs to be removed by unscrewing 6 screws (*fig.06.09*).



06.09 Tilt encoder belt.

Once there is access to the belt, it can be tight also using the 4 slotted holes in the encoder. Just loose the screws holding the encoder and slide it in or out to apply more tension. To replace it, loose it completely the screws and the tension of the belt will go off.

- Commercial reference for encoder belts: T2.5 540
- Commercial reference for pan encoder belts (S17'/S23'L): T2.5 600

6.4.1.3 MAIN MOTOR BELT



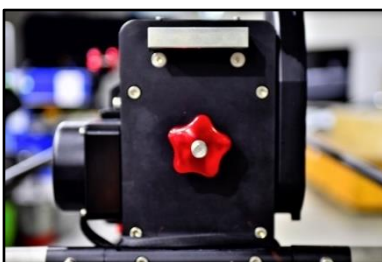
06.10 Main motor belt.

On the rear right part there is a cover protecting the belt of the main motor. Once the cover is removed, there is access to the four screws holding the motor. Loosening the motors' screws the tension of the belt can be adjusted. If the tension is completely loose, the belt can be removed.

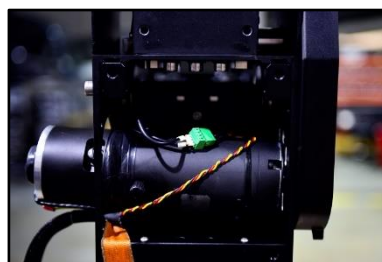
- Commercial reference for S10' motor belt: 600-5M-9
- Commercial reference for S17'/S23'L motor belt: 835-5M-HT

6.4.2 PARTS REPLACEMENT

6.4.2.1 MAIN MOTOR



06.11 Rear cover of the arm.



06.12 Main motor detached.

The first thing to do in order to replace the motor is to remove the main motor belt and loosen all the screws for the motor as seen in the previous chapter. Once the belt is removed, open the rear cover of the arm and the left cover of the motor. Then loosen all the screws of the motor and it can be pulled from

the motor cover. Disconnect the motor from the Electronic box and disconnect the green connector from the magnetic limits. The motor can be removed now.

Note: When the motor is changed the driver needs to be adjusted

6.4.2.2 MAGNETIC LIMITS

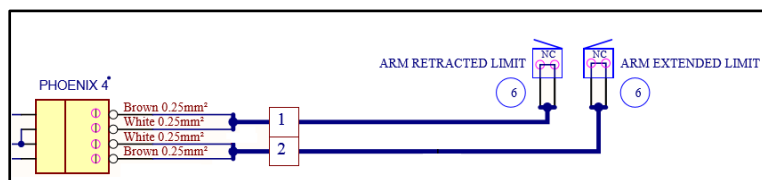
With the rear cover of the arm dismantled, there is access to the magnetic limit's connector (*green*). Replace the magnetic limit and connect it as the one removed.



06.13 Limits connector.

These magnetic limits work with the magnetic field generated by the magnets located on the counterweight trolley and the right side of the first section. The signal of the limits is only used when the crane is started in order to have a reference position of the arm.

Since there is not just one point where the magnetic field starts (*the closer to the magnet, the stronger the field*), there could be small variations of position when the sensor detects these fields (*mainly depends on the speed of the arm finding those limits*). From Servicevision we recommend moving the arm slowly when finding these limits in order to ensure that the reading of the limit is in the right position.



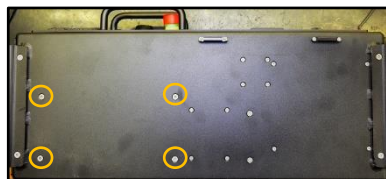
06.14 Limits connection.

In case one of these sensors fails it is possible to bypass it by cross connecting the two cables of the limit that is not working and always use the other limit as the reference position of the arm. This operation is just for emergencies and the limit that does not work needs to be replaced as soon as possible. Servicevision will not be responsible of any damage caused in the equipment if the crane works under this circumstance.

6.4.3 UPGRADE THE MOTOR AND THE ELECTRONIC BOX FROM V1 TO V2 ON S10'

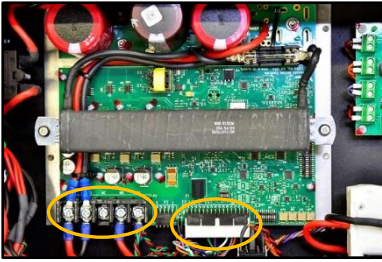
Till the date, there are two versions of motors for the Scorpio 10'. The V1 and the V2. The main difference is that the V2 has better performance regarding power consumption but in order to use it there must be some components modified in the Electronic box.

To change the motor from V1 to V2, simply follow the instructions detailed in the [chapter 6.4.2.1 Replace main motor](#). Notice that the V2 motor is longer than the V1. Servicevision will provide with an extension for the left side cover in order to fit the new motor.



06.15 Bottom of the E.B.

Servicevision will also provide a new driver and a new cover for the E.B. Both needs to be replaced in order to get a good performance of the crane. To change the old driver board, remove the four screws marked on *fig.06.15*. Then disconnect the connectors from the driver and connect them exactly in the same pins on the new driver.



06.16 Driver V1.

The main difference on the driver is the Shunt resistance, and the dip switch configuration. Be sure to connect everything as the removed driver.

The shunt connector in the V2 is located on the cover, there is only one way to connect it into the driver.

Note: When the motor is changed the driver needs to be adjusted accordingly ([chapter 6.7 Driver adjustment](#)).

There are different DIP switches on the PCB board, verify the configuration of those DIP switches with the following table:

	Driver V1		Driver V2	
	ON	OFF	ON	OFF
SW1	2,3,4,7	1,5,6,8,9,10	2,3,4,7	1,5,6,8,9,10
SW2	1,3,4	2	1,2,4	3
SW3	1,2,3,4,5,6,7,8,9	10	1,2,3,4,5,6,7,8,9	10
SW4	-	1,2,3,4,5,6,7,8,9,10	-	1,2,3,4,5,6,7,8,9,10

6.4.4 REPLACEMENT OF THE ELECTRONIC BOX

The Scorpio light series cranes offer the possibility to use an EB box from one crane model into another just by making some internal changes.

Internally, the Electronic Box for the S17' and the S23'L are the same, the only difference is the dip switch configuration for the SERVO of the arm. It is possible to change the EB from a S23'L to a S17' or vice versa only by changing the dip switch of the SERVO (see [chapter 9.3 other documentation for the dip switches configurations](#)).

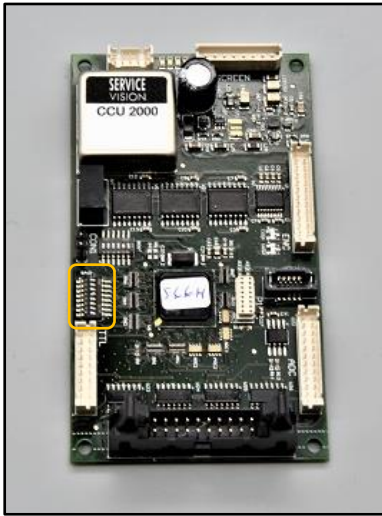
The EB for the S10' has a different SERVO dip switch configuration too, and also a different CCU dip switch and a different DRIVER board. By changing the dip switch configuration for the SERVO and the CCU it is possible to use it on a S17' or a S23'L and vice versa.

Warning: In the event of using a mismatching electronic box and crane (fig.04.02), if the dip switches are not properly adjusted the arm can suffer damage beyond repair. Please adjust the dip switch configuration for all the cases.

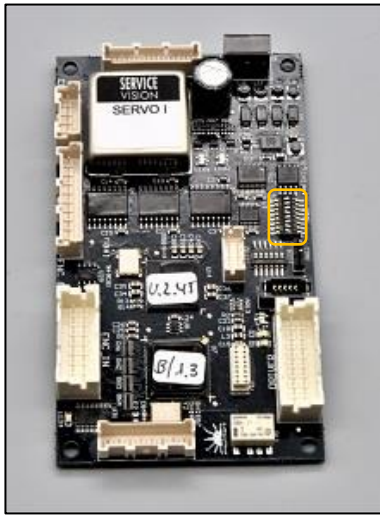
Since the EB for the S10' has a different driver board, the performance of this EB in the bigger cranes will be decreased in terms of speed and load capacity.

The use of an EB for the S17'/S23'L in a Scorpio 10' crane for long periods of time may damage the crane motor due to the bigger amperage applied to the motor.

6.5 ELECTRONIC BOARDS



06.17 CCU2000 | DIP switch.



06.18 SERVO | DIP switch.

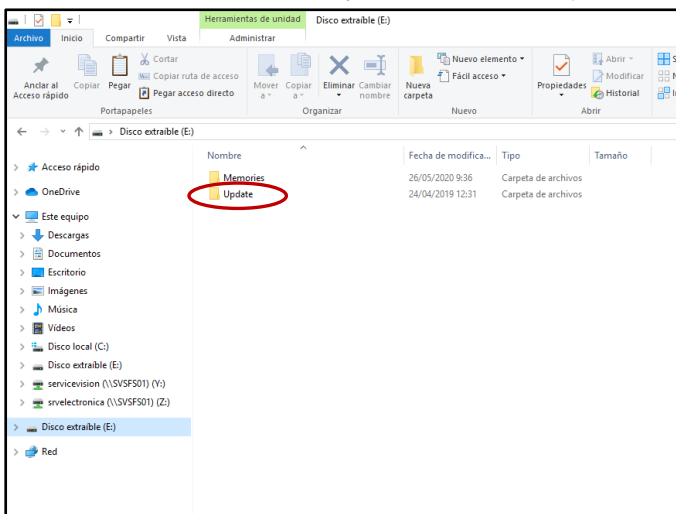
There are 2 kind of electronic boards inside of the crane: the SERVO and the CCU. They look very similar, but they make different functions. The CCU controls the user interface and the SERVO controls motors. To replace them, remove all the connectors from the board, unscrew the plastic screws holding the board and remove them from the system. Notice that every board have a DIP switch on it. Be sure to copy the DIP switch of the board **BEFORE** removing the damaged board.

In the [chapter 9.3 Other documentation](#) there is information of the possible DIP switch configurations for the SERVO and the CCU. There is one SERVO inside the electronic box and one SERVO inside the leveling head. There is only one CCU board placed inside the electronic box.

There is one driver board inside the electronic box to control the motor of the arm and there is another driver in the leveling head. To change the main arm driver, remove the four screws from the bottom part of the E.B. marked on *fig.06.15*. Then disconnect the connectors from the driver and connect them exactly in the same pins on the new driver. The driver for the leveling head can be accessed by removing the labeled cover from the leveling head. Disconnect the connectors from the driver and connect them as the removed one. The drivers need to be adjusted for every motor. In the [chapter 6.7 Driver adjustment](#) it is explained how to adjust them.

6.6 LOADING SOFTWARE TO THE SERVO/CCU

In the electronic box there is a slot for SD Cards. The SD Card reader is normally connected to the CCU but there is one connector in the SERVOS also to connect the SD Card reader. To LOAD software in the boards the software needs to be inside an SD Card. Servicevision will send to the users a new software every time it is developed. This software will be a file called "XXXX.bin".



06.19 Folder called UPDATE inside the root of the SD CARD.

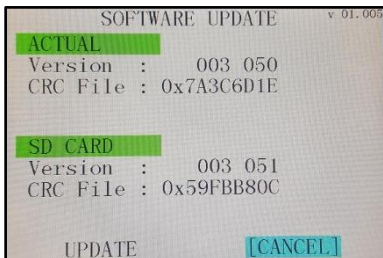
Copy the software file (*.bin) inside the UPDATE folder. The access path should be:

X:\UPDATE*.bin. (*X is the name of the SD CARD in the computer*).

Once the file is in the folder called **update (only one file in the folder)**, introduce the SD card into the loader and connect it to the board to be updated.

6.6.1 CCU SOFTWARE UPDATE

The CCU controls all the functions that the head/crane can perform. There are two different kind of software for the CCU depending on if it is inside a crane or in a control for the head. To identify them, on the name of the file there is an H or a C depending on this (“CCU_C.v05.68xxxxx.bin” for example).



06.20 CCU2000 UPDATE screen.

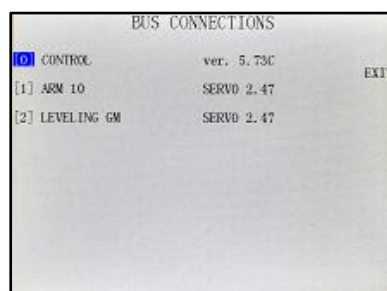
With the software for the CCU inside the SD Card and the SD Card reader connected into the CCU, start the crane. The system will identify the new software and it will use the display to ask if the user wants to complete the update.

Once the software has been updated remove the software from the SD Card.

Note: It is not needed a portable screen to do an update. If there is no display connected, the system will automatically load to the software from the SD card into the CCU.

6.6.2 SERVO I SOFTWARE UPDATE

The servo controls the movement of the motor connected to it. It is not common to update it, but it can be done with the SD card reader connected into the SD card connector.



06.21 Bus connections.

With the software for the SERVO inside the SD Card, connect the SD card reader to the SERVO. Once it is connected, start the crane. The Servo Board will make a LED sequence inside. Once the Outside LED of the SERVO flashes fix RED, the new software would have been UPDATED and the system may start booting as normally. To ensure that the new software is loaded, verify it in the MENU→AUXILIARY→BUS CONNECTIONS.

6.7 DRIVER ADJUSTMENT

Before doing any adjustment of any driver ensure that the hand command is correctly adjusted ([Chapter 4.2.4.2 Command adjust](#)).



06.22 Arm driver.

Any spare driver will be pre-adjusted at factory but since every motor is different it may need a fine adjustment once replaced. In the Electronic Box for the Scorpio 10'/17'/23'L there is the Arm Driver. Under the labeled cover of the Leveling Head there is the Leveling driver.

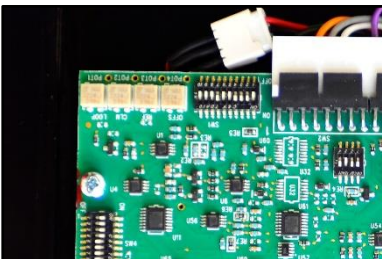
6.7.1 S10' ARM DRIVER

There are different DIP switches on the PCB board, verify the configuration of those DIP switches with the following table for driver V2:

SW1	2,3,4,7 ON	1,5,6,8,9,10 OFF
SW2	1,2,4 ON	3 OFF
SW3	1,2,3,4,5,6,7,8,9 ON	10 OFF
SW4	-	1,2,3,4,5,6,7,8,9,10 OFF

Once this is verified, start the crane, and find the magnetic limits of the crane. When the main screen is shown, the driver can be adjusted.

There are 4 potentiometers in the connectors side. These potentiometers adjust different parameters of the behavior of the motor and there is no mechanical limit on the numbers of turns they can do.



06.23 Driver potentiometers.

- Potentiometer 1 Loop Gain: Turn the potentiometer number 1 CLOCKWISE until hearing a “coupling” noise from the motor. From this point, turn counterclockwise now until the “buzz” noise stops. And from this exact point, keep turning counterclockwise for 1,5 turns more and stop.
- Potentiometer 2 Current Limit: Always needs to be giving the maximum current. Turn the potentiometer number 2 CLOCKWISE until hearing a “click” noise or during 15 full turns CLOCKWISE to reach its maximum.
- Potentiometer 3 Ref in Gain / SPEED: Always needs to be giving the maximum current. Turn the potentiometer number 2 CLOCKWISE until hearing a “click” noise or during 15 full turns CLOCKWISE to reach its maximum. There is one test it can be performed to see if this potentiometer is properly adjusted: Move the crane to one end and move it from there at 100% Speed and 0% Damping. When the crane reaches the middle of the movement, release the hand from the rocker. The crane needs to

stop at that exact time. If it is delayed, turn CLOCKWISE this potentiometer. If it is too stiff, turn it COUNTERCLOCKWISE.

- Potentiometer 4 Test/offset: This potentiometer adjusts the offset or zero of the motor. Turn the potentiometer until the motor stops spinning while enabling and disabling the standby button.

6.7.2 S17'/S23'L ARM DRIVER

There is only one DIP switch in the driver for the S17'/S23'L arm:

SW1	3,4,5,8 ON	1,2,6,7,9,10 OFF
-----	------------	------------------

Once this is verified, start the crane, and find the magnetic limits of the crane. When the main screen is shown, the driver can be adjusted.

There are 4 potentiometers in the connectors side (*bottom right corner on fig.06.25*). These potentiometers adjust different parameters of the motor behavior and the range of these potentiometers is 15 turns.



06.24 S17'/S23'L Driver.



06.25 S17'/S23'L Driver potentiometers.

- Potentiometer 1 Loop Gain: Turn the potentiometer number 1 CLOCKWISE until hearing a “coupling” noise from the motor. From this point, turn counterclockwise now until the “buzz” noise stops. And from this exact point, keep turning counterclockwise for 1,5 turns more and stop.
- Potentiometer 2 Current Limit: Turn the potentiometer number 2 CLOCKWISE until hearing a “click” noise or during 15 full turns CLOCKWISE to reach its maximum value. From this point, move one turn COUNTERCLOCKWISE.
- Potentiometer 3 Ref in Gain / SPEED: To adjust the speed it is mandatory to DISENGAGE the motor of the crane. Switch off the Electronic Box and remove the belt from the main motor as seen in [chapter 6.4.1 Belts on the crane](#). Then change the SERVO I Switch SAd1 direction to MOTOR FREEWHEEL (1,2,3,4 ON) (*check DIP switches for SERVO I in the [other documentation chapter](#)*). Switch on the Electronic Box again and turn the potentiometer clockwise 15 times then turn counterclockwise slowly until the noise of the motor changes. With the help of a multimeter, keep adjusting until the voltage value in the Motor Power Terminals (MOT A, MOT B) is between 27V and 28V (any value into this range will be considered as correct). Power off the Electronic Box and set the SERVO I DIP switch 1 as it was.
- Potentiometer 4 Test/offset: This potentiometer adjusts the offset or zero of the motor. Turn the potentiometer until the motor stops spinning while enabling and disabling the standby button.

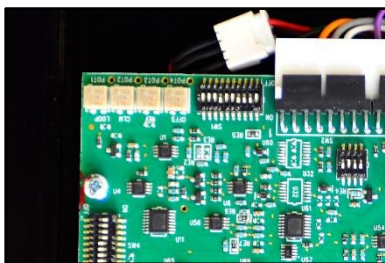
6.7.3 LEVELING HEAD DRIVER

There are different DIP switches on the PCB board, verify the configuration of those DIP switches with the following table for the LH driver:

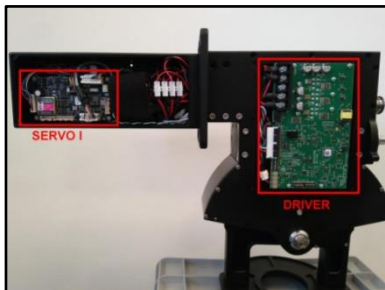
SW1	2,3,4,7 ON	1,5,6,8,9,10 OFF
SW2	1, 2, 4 ON	3 OFF
SW3	1,2,3,4,5,6,7,8,9 ON	10 OFF
SW4	1, 2, 3, 4	5,6,7,8,9,10 OFF

Once this is verified, start the crane, and find the magnetic limits of the crane. When the main screen is shown, the driver can be adjusted.

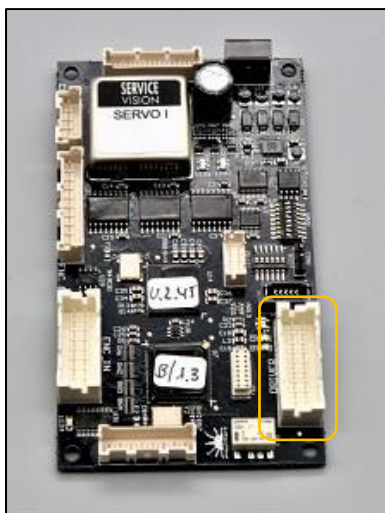
There are 4 potentiometers in the connectors side. These potentiometers adjust different parameters of the behavior of the motor and there is no mechanical limit on the numbers of turns they can do.



06.26 Driver potentiometers.



06.27 LH open, SERVO access.



06.28 SERVO I Driver connector.

- **Potentiometer 1 Loop Gain:** Turn the potentiometer number 1 **CLOCKWISE** until hearing a “coupling” noise from the motor. From this point, turn counterclockwise now until the “buzz” noise stops. And from this exact point, keep turning counterclockwise for 1,5 turns more and stop. Try to be as accurate as possible.
- **Potentiometer 2 Current Limit:** Always needs to be giving the maximum current. Turn the potentiometer number 2 **CLOCKWISE** until hearing a “click” noise or during 15 full turns **CLOCKWISE** to reach its maximum.
- **Potentiometer 3 Ref in Gain / SPEED:** To adjust the speed it is mandatory to **DISENGAGE** the motor of the crane. Switch off the Electronic Box and remove the belt for the leveling head as seen in [chapter 6.4.1 Belts on the crane](#). Then change the SERVO I Switch SAd1 direction to **MOTOR FREEWHEEL** (1,2,3,4 ON) (check the [chapter 9.3 Other documentation](#)). Switch on the Electronic Box again and turn the potentiometer clockwise 15 times then turn counterclockwise slowly until the noise of the motor changes. With the help of a multimeter, keep adjusting until the voltage value in the Motor Power Terminals (MA, MB) is between 27V and 28V (any value into this range will be considered as correct). Switch off the Electronic Box and set the SERVO DIP switch 1 as it was (2,3,5 ON).
- **Potentiometer 4 Offset:** Remove the DRIVER connector in the Servo I board, checking if there is any movement in the motor. If so, turn the potentiometer clockwise or counterclockwise until the movement disappears. Connect the DRIVER connector of the Servo I board again and engage the motor to the mechanics again with the belt.

WARNING: in FREEWHEEL mode, when the system is powered on, the motor will run freewheel!

7 F.A.Q. / COMMON PROBLEMS

7.1 POSSIBLE PROBLEMS RELATED TO THE LH

If the leveling Head does not work properly, it could be for different reasons as follow:

Symptom	Procedure to follow
The Leveling Head does not communicate with the electronic box when the crane starts	<ul style="list-style-type: none"> -Check if the LH cable is connected. -Check if the FUSE for the LH is released. -Change the LH cable.
The Leveling Head finds the level when the system starts but is not a good level	It could be possible that one of the sensors incorporated in the leveling head loses the reference position. It is possible to recalibrate the horizon level. To do it, see the chapter 6.3 Maintenances .
The leveling Head finds the level properly but does not correct the movement of the crane	<p>If the leveling head finds the level properly, the problem is not in the leveling head. The information to correct the movement of the crane come from the <i>Tilt encoder</i> located in the fulcrum (chapter 2.3 Fulcrum). It could be that the information from the Tilt encoder does not reach the leveling head for some reason.</p> <ul style="list-style-type: none"> -Check if the tilt encoder information reaches the Electronic Box (<i>the degrees for tilt may change</i>). If there is no change in the E.B., change the tilt encoder cable. -Change the LH cable.

If the LED of the servo blinks in orange different times, there could be an error on the sensors that the leveling head uses to find the horizon. The Leveling Head can work under the conditions detailed on the next table:

SERVO LED consecutive blinks in ORANGE	Procedure to follow
1	<p>Problems detected with the inclinometer.</p> <p>The LH can work properly in auto or manual mode, but the crane is unable to detect the initial arm tilt. It is recommended to restart the crane with the arm at 0° and ensure that the LH will not reach the mechanical limit of the half-moon gear because electronically cannot be detected.</p>
2	<p>Problems with the accelerometer.</p> <p>With this error, the LH cannot work in auto mode and the LH will act as it is set in manual mode. As on the previous error code, it is recommended to restart the crane with the arm at 0° and ensure that the LH will not reach the mechanical limit of the half-moon gear because electronically cannot be detected.</p>
3	<p>Problems with both sensors.</p> <p>The LH cannot detect the inclination of the arm neither the horizon. As on the previous error code, it is recommended to restart the crane with the arm at 0° and ensure that the LH will not reach the mechanical limit of the half-moon gear because electronically cannot be detected.</p> <p>Since the LH is unable to detect its position, the AUTO or MANUAL switch will be used to inform the LH if it is over or underslung. To do so, always point the switch down (<i>AUTO for underslung and MANUAL for over</i>).</p>

7.2 POSSIBLE PROBLEMS RELATED TO THE COLUMN

Symptom	Procedure to follow
The column does not move manually	-Check if the screws of the column are loose.






7.3 POSSIBLE PROBLEMS RELATED TO THE ARM

The most common problems related to the Arm are:

Symptom	Procedure to follow
There is no Alarm, but the Arm does not move	-Check the speed of the Hand Command. -Check if there are limits sets on the movement of the Arm. -Check if there is something blocking the movement of the Arm.
There is no light in the screen	-Check the cable for the display.
The system does not start	-Check if all the securities are connected (<i>Hand Command, Emergency stop, start button</i>). -Change the cable for the Hand Command.
The arm only moves in one direction when finding limits.	-Check if there is something blocking the movement of the crane -Check in the TTL screen to see if the crane detects one of the magnetic limits even if it is not in the limits position. If so, that magnetic limit is broken, either the cable is broken/disconnected, or the sensor is broken. -In the maintenances chapter it is explained how to bypass the limits under the operator responsibility.
The arm does not move when finding limits and it disconnects itself	-Verify that the locking pin for the arm is released.
In the display appears "Motor burnt, or motor cable disconnected"	-Check if the main motor cable is connected. -Check if the magnetic limits of the arm are arriving at the electronic box (<i>TTL screen or check that both LEDs of the Relay board are ON inside the E.B.</i>).
There is a bad movement of the arm: when the arm is moved, it jerks.	-Check if there is enough power arriving to the crane. If the crane has a heavy payload and the movement being done is fast, try to use a bigger power supply (40A.).
The crane arm drift by itself	-Restart the crane. -Using the display, calibrate the potentiometer from the Hand Command (chapter Command adjust 4.2.4.2).
The telescopic arm moves faster in one direction than another	-Using the display, calibrate the potentiometer from the Hand Command (chapter Command adjust 4.2.4.2).
The range of the arm is different every time the crane is started	-Depending on how fast the magnetic limit stops detecting this distance may vary. Once the limit is detected, move slowly out of the physical limit.
There is an error message with a mismatch between the DIP switch and the equipment	Change the DIP switch on the Electronic Box accordingly as seen in chapter 6.4.4 Replacement of the Electronic Box .

7.4 FUSES

It could be that one of the fuses inside the electronic box is broken. The way to know which fuse is blown is the next one:

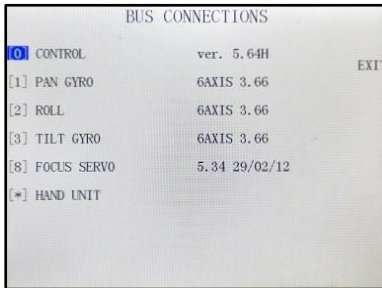
Symptom	Fuse	Description
The system does not start	 <p>2 AMP</p>	This fuse is located in the security system board. It protects all the securities of the system (HC, Start button and Emergency stop).
The Power Unit does not give any output voltage	 <p>15 AMP</p>	The P.U. is a 30v 40Amp power supply. It has a 15Amp fuse in the back part. It is powered from AC current and has two 3pin XLR outputs for the remote head.
When the rocker in the Hand Command sends signal, there is an error message in the screen and the motor does not move	 <p>D.ARM FUSE</p>	This fuse protects the arm motor in case the cable is broken, try to release it.
The Leveling Head has no power	 <p>L.H. FUSE</p>	This fuse protects the leveling head in case the leveling head cable is broken.
When the crane stops, it does not stop smoothly	 <p>10 AMP</p>	This is a fuse in the SHUNT AMP. It protects the SHUNT resistance of the ARM driver.

8 SPECIAL CONFIGURATIONS

8.1 INTERFACE WITH SCORPIO HEADS

In the Electronic Box of the Scorpio Cranes there is one connector that connects the crane with the control of the Scorpio Head. By doing this the system can perform special features such as Motion Generator or Back Pan.

8.1.1 SET UP CONDITIONS



08.01 Bus connection screen in SSHV.

These functions are available with any regular Scorpio Head (Classic/Mini/Mini EZ or Micro) that has a SERVO F, SERVO I board (or a newer version) and a control with the CCU2000 (*Handwheels, Pan bar...*) with a software version newer than 5.87H. The Mini Scorpio Stab V head can perform this feature only in regular mode. The CCU2000 controls are easily identified because the control has **white screen touch panel**. To identify the SERVO versions of the HEAD it can be done by connecting the remote head to the control and opening the *MENU*→*Auxiliary*→*Bus connections*. There is a list of

the SERVOS connected to the control. If the name of one of the axes is HEAD SERVO, it will not be possible to set up this function (*the boards inside the head need to be upgraded*). The stabilized heads (*Stab, Stab V*) can also use these functions only if the Stab mode is disabled.

Regarding the crane, any crane (*S10'/S17'/S23'L/S23'/S30'+7'/S38' or S45'*) can perform this feature if the electronic box on the crane is updated to CCU2000 (*there is a white screen touch panel*) and the software version of the crane is newer than 5.80C.

8.1.2 SET UP



08.02 Connectors to be linked.

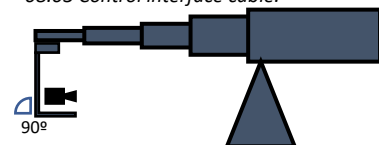
To start connecting the Head and the Crane, the control interface cable (*fig. 08.03*) can be used to send the communication line from the control interface connector from the EB to the FIZ Command connector in the back of the control of the Scorpio Head (*fig.08.02*).

A standard communication cable from Servicevision (*6pin XLR*) can be used to extend the link from the control interface connector of the crane to the Control interface cable.



08.03 Control interface cable.

Once the cables are connected the crane and the head can be started.

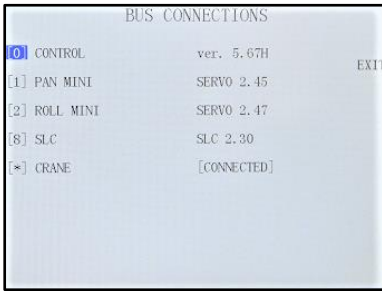


08.04 Head pointing to the crane in the horizontal position to set the ZERO POSITION

Note: In case the user wants to use the Motion Generator mode, the ZERO POSITION of the head needs to be set with the remote head looking to the crane in the horizontal position (center the camera in the pan axis for better performance).

All the following functions are based on that Zero position.

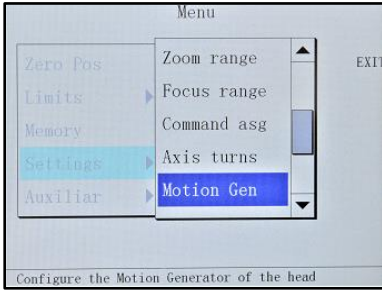
The only function that does not require the Zero position is the Back-Pan function.



08.05 Bus connections in head control.

Once the crane has been started, it has found the physical limits and the main screen is shown in the display of the crane, the communication between the crane and the head is engaged. It can be checked in the MENU→Auxiliary→Bus connections from the head control. In this screen it can be seen the [*] CRANE identified by the head control and the status [CONNECTED] (fig.08.05).

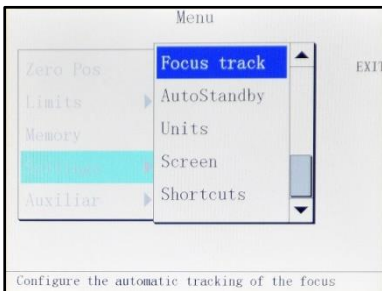
Note: The crane needs to be engaged all the time to use the Control interface (not compatible with the standby mode).



08.06 Motion Gen in head settings.

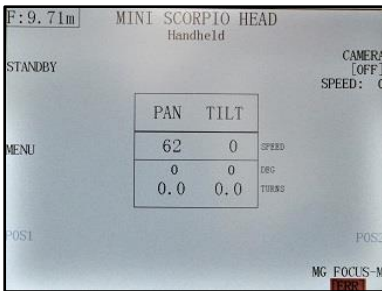
When the communication between the head and the crane is established, the Motion Gen menu is available in the MENU→Settings→Motion Gen.

The focus tracking function also appears now in the control of the head in MENU→ Settings→ Focus track.



08.06b Focus track in settings.

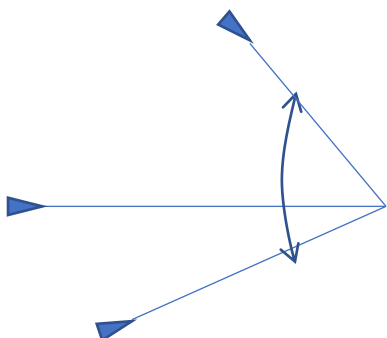
It is recommended to set a shortcut of these menus in the main screen to have a quick access in case any adjustment needs to be done. It will also warn the user in case the crane gets disconnected displaying an error message in the main screen (fig. 08.07).



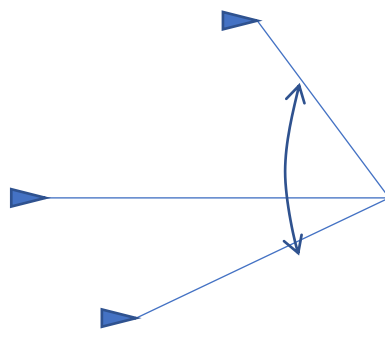
08.07 Crane not detected ERROR.

8.1.3 BACK-PAN

In a normal operation mode, the remote head holds always the same position respect the crane. This means that if the arm of the crane swings left or right, the remote head will change the perspective of the camera by the same number of degrees that the arm has swung in order to maintain the same position respect the crane (*fig. 08.08*).

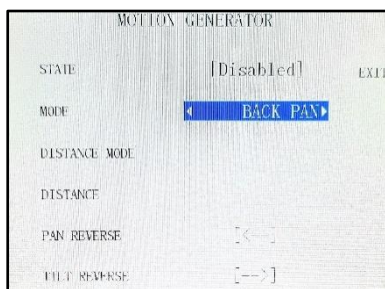


08.08 Camera point of view in different positions of the arm.



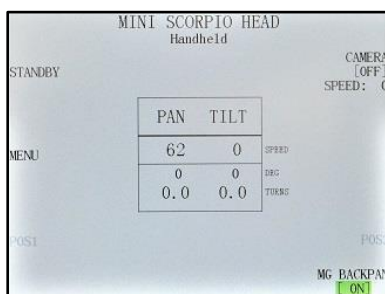
08.09 Camera point of view in different positions of the arm w/ Back-Pan ON.

The Back-Pan function makes the head to hold the same infinity point even if the crane swings left or right (*fig. 08.09*). It will only work in the Pan axis to correct the swing of the crane.



08.10 Back Pan mode in Motion Gen.

To activate this function, select it in the MODE tab of the *Motion Generator* menu by pressing on the sides of the name and change the state from Disabled to Enabled by the same way.



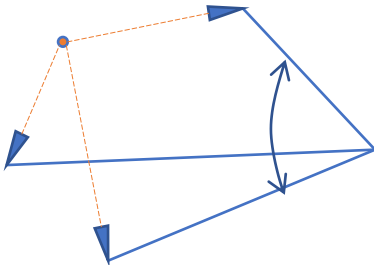
08.11 Shortcut of B. pan in main screen.

In case that the remote head does not correct in the proper direction, change the tab for PAN REVERSE. This tab is to change the direction of correction depending on the model of the head or in case the head is mounted Over slung (*the state has to be DISABLED*).

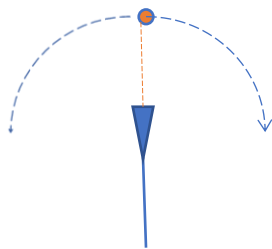
If a shortcut is created, in the main screen it will be possible to activate or deactivate it once it has been configured just by short pressing on the shortcut.

8.1.4 TRACKING MODE

The Scorpio systems have fully encoded information regarding the position of the crane and the head in space. From a reference point called *Zero Position*, the system knows how many degrees the crane or the remote head has changed in every axis. This is why it is important to set the *Zero position* of the remote head and the crane always the same: with the camera facing the column of the crane in the horizontal position ([see chapter 8.1.2 Set up](#)).



08.12 Different position of the crane with the remote head tracking the same point.



08.13 Moving the tracking point when Panning on the remote head.

With that information, the *Motion Generator* allows the system to generate one tracking point in the space and to keep the camera looking to that point even if the crane change the position of the camera in the space (*fig. 08.12*).

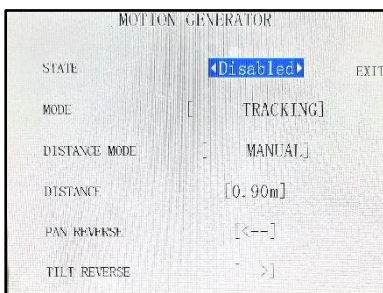
The only thing that the system needs to know is where to generate the tracking point. The way to do this is by giving to the system the distance from the center of the remote head to the point to be tracked.

Note: This function is not a Motion Control, there are some tolerances to consider when using this function. In order to minimize these deviations, introduce the minimum distance as possible to the point to be tracked (approach the camera to the target). The minimum distance is 0.20m (7.8 inches)

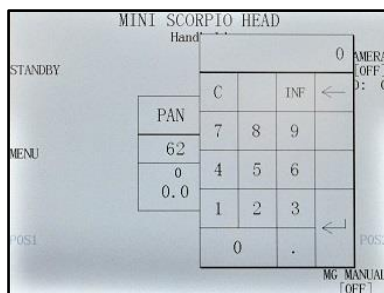
It is important to notice that it will always be possible to move the remote head from the control desk. The only difference is that instead of moving the axes of the head, the user will be moving the tracking point in the space depending on the distance to the tracking point. This can be used to readjust the point where the shot requires.

Depending on how the distance to the tracking point is introduced to the system, there are three different modes: *Manual*, *Focus M.*, and *Focus*. To use the *Focus M.* and the *Focus* modes a *Scorpio Focus* or a *Servo Lens Control* needs to be connected to the system, otherwise they will not be displayed.

MANUAL DISTANCE



08.14 Manual mode in Motion Gen.



08.15 Keypad to introduce distance.

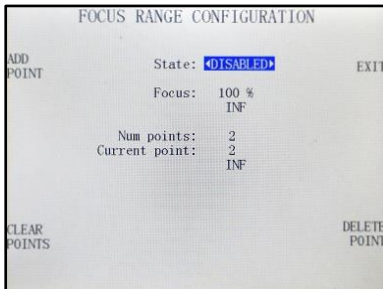
When the distance manual mode is selected, we can introduce a distance to set the tracking point. If the number between the brackets in the *DISTANCE MODE* tab is pressed, a keypad will be opened to introduce the distance between the camera and the target. Measure this distance from the center of the head. The minimum distance is always 0.20cm (7.8 inches).

There is also the possibility to reverse the pan and the tilt corrections depending on the model of the head or in case the head is mounted over slung and the corrections in those axes are in the wrong

direction. If there is a shortcut to the M.G., just by short pressing the shortcut the keypad will be opened to introduce the distance. If the shortcut is long pressed, it will open the M.G. menu.

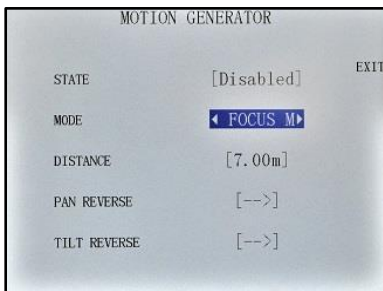
DISTANCE BY FOCUS M

If there is a Scorpio Focus connected to the system, it is possible to introduce lens points in the system in the *MENU*→*Settings*→*Focus Range* (fig. 08.16). This is mandatory to use the Focus M or the Focus functions.

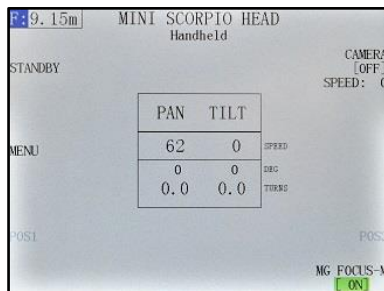


08.16 Focus Range screen.

In this menu it is possible to copy the lens focal scale into the system in order to be displayed in the main screen. To do so, move the focus motor until one of the focal marks on the lens. In this mark press the ADD POINT button. A keypad will appear to introduce the focal distance mark (using the enter button). Now repeat the same process with the rest of the marks on the lens. Once all the marks are introduced and the state is ENABLED, in the main screen will be displayed the current focal length and this can be used to introduce the distance to the Motion Generator.



08.17 Focus M mode in Motion Gen.



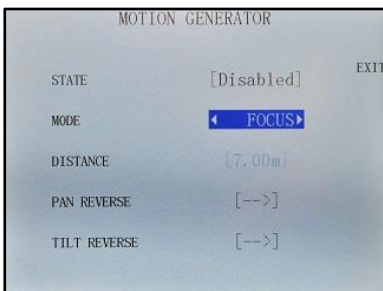
08.18 Focus M enabled main screen.

When the Focus M MODE is selected, the distance of the initial tracking point will be determined by the current focal length when the system is ENABLED.

If there is a shortcut to the M.G., it is possible to generate a new point at the current focal distance by pressing the blue F at the left-upper corner of the screen (fig.08.18).

DISTANCE BY FOCUS

To use the Focus function, a Scorpio Focus needs to be connected to the system and the focal lengths needs to be previously introduced (as in the Focus M mode).



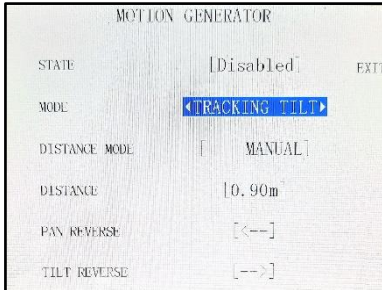
08.19 Focus mode in Motion Gen.

Once the Lens data is visible in the main screen, select the FOCUS mode in the Motion Generator menu. Now the distance of the point changes with the focal distance in real time as the focus puller moves the lens.

Note: When using the Motion Generator, it is important to respect the same Zero position for the head and the crane ALL THE TIME. Functions as the Arc compensator needs to be used without Reset pan feature due to the Zero position of the crane will change.

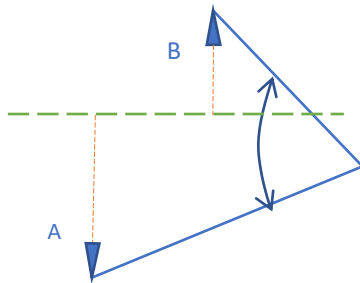
8.1.5 TRACKING TILT

This mode has been added in order to perform a circular movement around a line and allow the tilt axis to move upside down in one side of that line.



08.20 Tracking tilt.

To use this function, point the head perpendicular to the imaginary line where you want to perform the circular movement and introduce the distance to that imaginary line using the different DISTANCE MODES seen in the previous chapter (*Manual, Focus M or Focus*). Once it is activated, any movement done by the crane will be corrected by the head to keep the camera pointing to that imaginary line (*parallel in the pan axis and the tilt around the line*). If the crane is moved to the opposite side of the line, the camera will be facing upside down.



08.21 Different position of the crane with the remote head tracking the same line.

A – Camera facing the line.

B – Camera facing the line upside down.

C – Imaginary line.

D – Distance to the imaginary line.

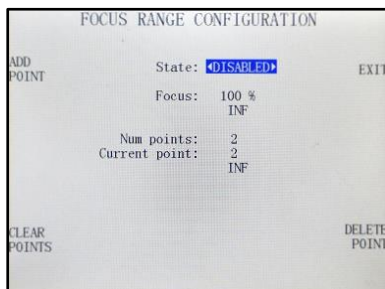
As seen on the diagram (fig.08.21), the camera starts in the position A and the distance from the point A to the imaginary line is introduced into the system. Once it is activated, the system will recalculate the distance to the imaginary line in any position of the crane and, in case the crane moves to the other side of the imaginary line (*point B*), it will be facing that line in an upside-down position.

This mode can be used together with the arc compensation feature of the crane to perform a perpendicular movement of the crane respect the imaginary line and track the same point of that line.

Note: All the restrictions applied to the tracking mode, also applies in the tracking tilt mode, such as respect the Zero position of the head and the crane all the time that the function is enabled or the minimal distance to the line of 0.20cm (7.8inches).

8.1.6 FOCUS TRACKING

The focus tracking is a function that keeps the focal distance at the same point regardless the movement of the crane. The different modes are: *TRACK CRANE*, *CINETAPE* and *CINETAPE M*.

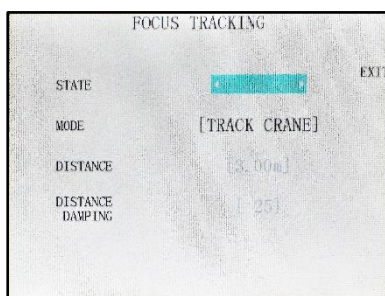


08.16b Focus Range screen.

To use any of these functions, a Scorpio Focus must be connected to the system by wire and the lens marks must be pre-introduced into the system. To introduce the lens points into the control for the head go to *MENU*→*Settings*→*Focus Range* (fig. 08.16b). Move the focus motor until one of the focal marks on the lens. In this mark press the ADD POINT button. A keypad will appear to introduce the focal distance mark (using the enter button). Now repeat the same process with the rest of the marks on the lens. Once all the marks are introduced and the state is ENABLED, in the main screen will be displayed the current focal length on the top left corner.

Note: The focus puller can always override any of these functions to readjust the focal distance to the target. The minimal focal distance to track is 0.50m (19 inches).

TRACK CRANE

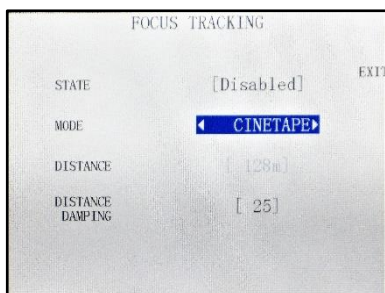


08.22 Track crane menu.

The track crane requires the motion generator feature to be enabled only in the manual distance mode ([chapter 8.1.3](#)).

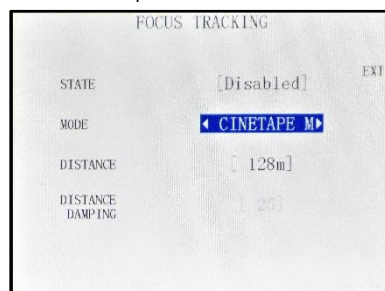
Once the motion generator is enabled and the point has been generated, it is possible to enable the track crane and the focal distance will be automatically adjusted to the same tracking point of the crane.

CINETAPE & CINETAPE M



08.23 Cinetape mode.

The Cinetape and the Cinetape M modes require to have a cinetape connected to the Scorpio Focus. When the CINETAPE mode is ENABLED, this mode will use the current distance reading of the cinetape to set the focal distance at that distance all the time. Since the reading of the cinetape can vary in high values depending on the proximity of the objects, there is the possibility to add damping to the movement of the focus motor in this screen.



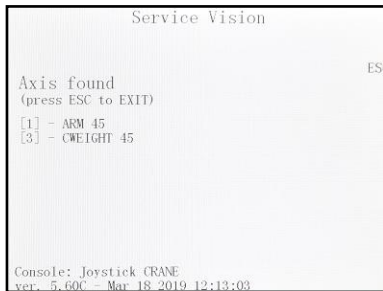
08.24 Cinetape M mode.

The Cinetape M mode will use the distance reading of the cinetape to set the focal point ONLY at the moment of enable it. If the distance reading changes after the mode has been enabled, the system will not change the focal distance to the new reading.

Note: The focus tracking functions are only available with software version newer than 5.87H for the HEAD CONTROL and newer than 5.80C for CRANE

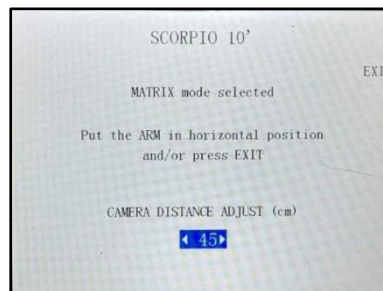
8.2 MATRIX MODE

The Matrix mode is a special mode to be used with any head that can be nose mounted to the crane.



08.25 Leveling Head not detected.

To enter in this working mode the Scorpio crane needs to be mounted without the leveling head and the Remote Head nose mounted instead. The system will not communicate with the leveling head (fig 08.25) when is started. To activate the mode, press the ESC button and the fig 08.26 will appear. This mode is available to allow the system to do proper calculations (for example in functions as the Arc compensator...) counting the size of the remote head. It is necessary to measure the distance from the camera center to the end of the crane (the attachment plate with the leveling head) and introduce it to the system (it can be in centimeters or inches).



08.26 Matrix mode selected.

Press EXIT when the crane is in the horizontal position, then work as in normal mode.

8.3 RECORD MEMORIES CRANE-HEAD

There is an accessory to synchronize the memories of the crane and the head in order to start them at the exact same time.



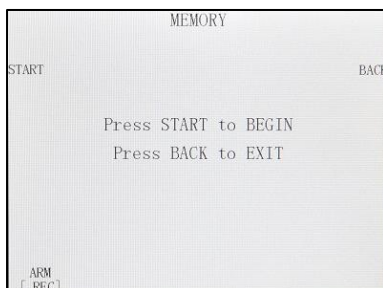
08.27 Analog & Digital Hand command.

To use this device, it is mandatory to know if the crane has been updated with a digital hand command. It is easy to identify it because the digital hand command is labeled as *digital hand command* and it has an LED on it and three buttons instead of only the green one.

Depending on which hand command the crane has, the trigger for the memories will be analogic or digital.

The control for the Scorpio Head does not need to be updated, just take in consideration that in any case the trigger for the head will be connected in the connector for the *JDR Roll* on the control desk.

8.3.1 SET UP CONDITIONS



08.28 Start recording screen.

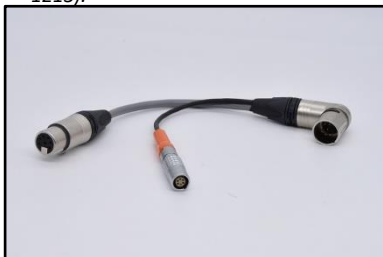
The first thing to do is to connect the memory trigger as shown on the respective diagrams depending on if the hand command is analog or digital.

Both controls (*crane & head control*) must have a screen display connected in order to have access to the memory menu. Once the axes to be recorded are set, press the *STARTUP* button on the screen and the fig. 08.28 will be displayed. Ensure that both controls have this screen displayed before pressing the start button.

8.3.2 ANALOG TRIGGER



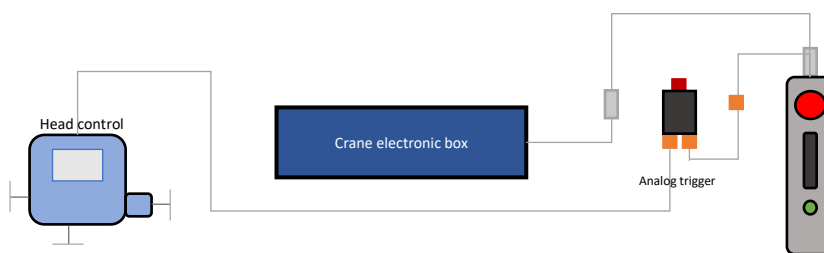
08.29 Analog memory trigger (Ref. 1213).



08.30 Adaptor for analog trigger (Ref. 7082).



08.31 Lemo 6pin male to male cable.



To start the memories of the head and the crane at the same time with the analog hand command, the adaptor cable (Ref. 7082) needs to be connected to the hand command. The 7pin XLR female goes to the hand command, the male can be extended with regular hand command cables to the electronic box of the crane.

The Lemo 6 pin female from the adaptor needs to be extended with a male-to-male cable (Fig. 08.31) into the analog trigger box. From the trigger box, another male-to-male Lemo cable needs to be connected into the head control in the *JDR Roll* connector in the back of the control.

With everything connected and the [8.3.1 Set up conditions](#) fulfilled, press the red button of the trigger and both memories will start at the same time.

To play them back at the same time, use the same procedure but instead of REC in the memory menu, select the axes in PLAY.

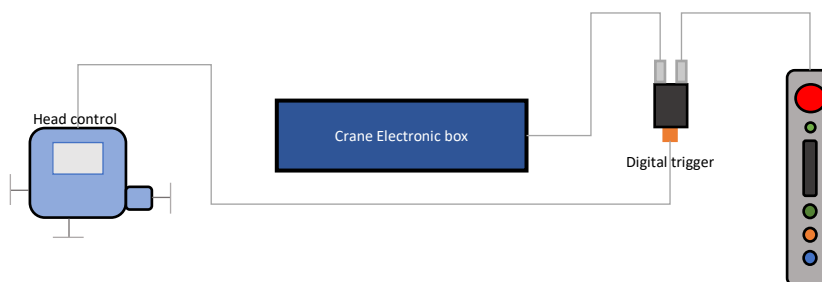
8.3.3 DIGITAL TRIGGER



08.32 Digital trigger memory (Ref. 7114).



08.33 Digital trigger memory 7pin connectors side.



To start the memories with the digital memory trigger, the hand command needs to be connected to the trigger with a regular hand command cable. Another regular hand command cable needs to be connected to the crane electronic box from the 7pin XLR male panel connector of the digital memory trigger. The 6 pin Lemo female from the trigger box needs to be connected to the *JDR Roll* connector in the back of the control with an extension cable (fig. 08.31).

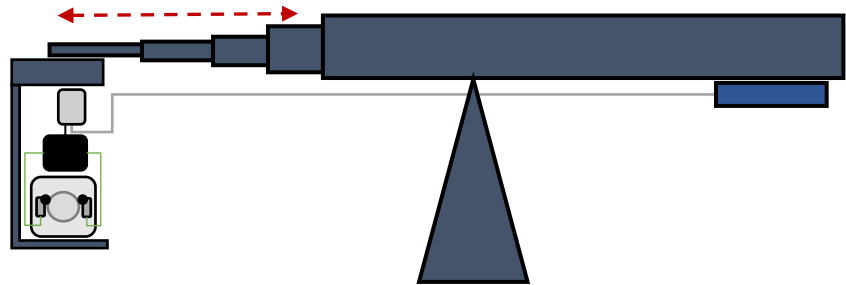
With everything connected and the [8.3.1 Set up conditions](#) fulfilled, press the green button of the hand command and both memories will start at the same time. To play them back at the same time, use the same procedure but instead of REC in the memory menu, set the axes to PLAY.

8.4 M.G. WITH SCORPIO FOCUS

Using the encoder output of the crane, it is possible to send the encoder signal of the telescopic arm into the M.G. connector of the Scorpio Focus to record focal and zoom points depending on the extension of the arm.



08.34 Encoder signal converter.



08.35 Encoder cable from E.B.

To connect the encoder from the arm into the M.G. of the Scorpio Motor driver box it is necessary to adapt the encoder signal using the encoder signal converter (fig. 08.34). The encoder cable from the E.B. (fig.08.35) sends the signal into the converter and from the converter into the M.G. connector of the motor driver box using the 4 pin Lemo cable (fig. 08.36).



08.36 Encoder cable to the M.G. connector.

Once everything is connected, link the motor driver box with the Scorpio focus hand command by cable or by radio and activate the motion generation feature.

When the extension of the arm changes, the motor driver box will detect that change and will allow the user to record points depending on the extension of the arm.

8.5 AUGMENTED REALITY

Servicevision products are equipped with encoder output connectors. From those connectors it is possible to read the number of pulses and with the encoder resolution and the gear factors provided in the documentation chapter of the manuals it is possible to have an accurate reading of the movement of the cranes and heads.



08.37 Encoder out connector from the cranes.

This information can be used in real time to generate graphics in the virtual set using different software providers.



08.38 Encoder out from an EZ head.

9 DOCUMENTATION

9.1 PINOUTS

Connectors in the Electronic Box:

12V/3A DC OUT (NEUTRIK 4 pins female panel NC4 FP1)

- 1 GROUND (Black)
- 2 NC
- 3 NC
- 4 VCC +12V (Red)

Levelling Head (BRUNDY 8 pins female panel UTGO 128S)

- 1 VCC +28V (Red)
- 2 GROUND (Black)
- 3 TILT ENC B1+ OUT (Green)
- 4 TILT ENC B1 - OUT (Blue)
- 5 485 - (Grey)
- 6 485 + (Blue)
- 7 TILT ENC A1- OUT (White)
- 8 TILT ENC A1+ - OUT (Brown)

Hand command digital (NEUTRIK 7pins female panel NC7FP1)

- 1 VCC +5V (Red)
- 2 GND (Black)
- 3 485 N (White)
- 4 485 P (Green)
- 5
- 6
- 7

Display Command (NEUTRICK 8 pins female panel ORP8F)

- 1 VCC +5V (Red)
- 2 GND (Black)
- 3 BUSY (Purple)
- 4 D OUT (Grey)
- 5 D IN (Blue)
- 6 VCC +12V (Orange)
- 7 GND (Brown)
- 8 DAMPING (Yellow)

Encoder travelling red (LEMO 10 pin female panel EGG -2B.310.CYM)

- 1 VCC (Red)
- 2 GROUND (Black)
- 3 ENC A+ (Green)
- 4 ENC A- (Blue)
- 5 ENC B+ (White)
- 6 ENC B- (Brown)
- 7 NC
- 8 NC
- 9 NC
- 10 NC

Encoder pan grey (LEMO 10 pin female panel EGG -2B.310.CYM)

- 1 VCC (Red)
- 2 GROUND (Black)
- 3 ENC A+ (Green)
- 4 ENC A- (Blue)
- 5 ENC B+ (White)
- 6 ENC B- (Brown)
- 7 NC
- 8 NC
- 9 NC
- 10 NC

Encoder tilt blue (LEMO 10 pin female panel EGG -2B.310.CYM)

- 1 VCC (Red)
- 2 GROUND (Black)
- 3 ENC A+ (Green)
- 4 ENC A- (Blue)
- 5 ENC B+ (White)
- 6 ENC B- (Brown)
- 7 NC
- 8 NC
- 9 NC
- 10 NC

Connector control interface (NEUTRICK 6 pins female panel N66FD_LX)

- 1
- 2
- 3
- 4
- 5 485 (Grey)
- 6 485 (Pink)

Encoders OUT (DB connector 25 female DB-25S-A191-A1977)

1 NC
2 NC
3 NC
4 NC
5 NC
6 NC
7 NC
8 NC
9 NC
10 A+ ARM (Green)
11 A- ARM (Blue)
12 B+ ARM (White)
13 B- ARM (Brown)
14 A+ PAN CRANE (Red)
15 A- PAN CRANE (Black)
16 B+ PAN CRANE (Yellow)
17 B- PAN CRANE (Orange)
18 A+ TILT CRANE (Green)
19 A- TILT CRANE (Blue)
20 B+ TILT CRANE (White)
21 B- TILT CRANE (Brown)
22 A+ TRACK CRANE (Green)
23 A- TRACK CRANE (Blue)
24 B+ TRACK CRANE (White)
25 B- TRACK CRANE (Brown)

9.2 WEIGHTS OF THE CRANES

COMMONLY USED WEIGHTS:

	SCORPIO 23'L	SCORPIO 17'	SCORPIO 10'
Crane assembled (truck load)	369.4 Kg. / 814 lb.	280 Kg. / 617 lb.	273,4 Kg. / 602.7 lb.
Max. Weight of the crane (Max payload)	752,8 Kg. / 1660 lb.	744,3Kg. / 1641 lb.	544,6 Kg. / 1200.6 lb.
Dolly, Column & fulcrum fully assembled	166,1 Kg. / 366,2 lb.	166,1 Kg. / 366,2 lb.	162 Kg. / 357,2 lb.
Empty arm	150 Kg. / 330,7 lb.	122 Kg. / 268,9lb.	68 Kg. / 149.9 lb.

DETAILED WEIGHTS OF THE CRANES:

	SCORPIO 23'L	SCORPIO 17'	SCORPIO 10'
Empty arm	150 Kg. / 330,7 lb.	122 Kg. / 268,9lb.	68 Kg. / 149.9 lb.
Counterweight's support	13,5 Kg. / 29,7 lb.	13,5 Kg. / 29,7 lb.	9 Kg. / 19.8 lb.
Leveling head	10,9 Kg. / 24 lb.	10,9 Kg. / 24 lb.	10,2 Kg. / 22.5 lb.
Power unit	5 Kg. / 11 lb.	5 Kg. / 11 lb.	5 Kg. / 11 lb.
Leveling head cable & Scorpio head cable	6,6 Kg. / 14,5 lb.	5,6 Kg. / 12,3 lb.	3,7 Kg. / 8,1 lb.
Rest of cables & hand unit	1,5 Kg. / 3,3 lb.	1,5 Kg. / 3,3 lb.	1,5 Kg. / 3,3 lb.
Electronic box	6,3 Kg. / 13,9 lb.	6,3 Kg. / 13,9 lb.	6,3 Kg. / 13,9 lb.
Protection bars & upper operation bars	8 Kg. / 17,6 lb.	6 Kg. / 13,2 lb.	6 Kg. / 13,2 lb.
Fulcrum	22,1 Kg. / 48,7 lb.	22,1 Kg. / 48,7 lb.	18 Kg. / 39,7 lb.
Column	24 Kg. / 52,9 lb.	24 Kg. / 52,9 lb.	24 Kg. / 52,9 lb.
Empty dolly (chassis)	58 Kg. / 127,8 lb.	58 Kg. / 127,8 lb.	58 Kg. / 127,8 lb.
Straps	0,7 Kg. / 1,5 lb.	0,7 Kg. / 1,5 lb.	0,7 Kg. / 1,5 lb.
Locking screws for weights (per side)	0,5 Kg. / 1,1 lb.	0,5 Kg. / 1,1 lb.	0,5 Kg. / 1,1 lb.
Weight bucket for dolly (x1)	7 Kg. / 15,4 lb.	7 Kg. / 15,4 lb.	7 Kg. / 15,4 lb.
Wheels (x1)	6 Kg. / 13,2 lb.	6 Kg. / 13,2 lb.	6 Kg. / 13,2 lb.
Leveling Jacks for wheels (x1)	2 Kg. / 4,4 lb.	2 Kg. / 4,4 lb.	2 Kg. / 4,4 lb.
Traveling wheels (x1)	2,5 Kg. / 5,5 lb.	2,5 Kg. / 5,5 lb.	2,5 Kg. / 5,5 lb.
Steering handle (x1)	3 Kg. / 6,6 lb.	3 Kg. / 6,6 lb.	3 Kg. / 6,6 lb.

TRANSPORT WEIGHTS:

Package	Format	Size	Weight
S10' Arm	Flight case	248x80x45 cm	204kg
S10' Dolly & Column	Plywood crate	139x94x76 cm	155kg
S10' Counterweights & CW dolly	Pallet	120x80x65 cm	400kg

Package	Format	Size	Weight
S17' Arm	Plywood crate	299x66x55 cm	240kg
S17' Fulcrum & accessories	Plywood crate	94x55x84 cm	109kg
S17' Dolly & Column	Plywood crate	139x94x76 cm	155kg
S17' Counterweights & CW dolly	Pallet	120x80x60 cm	420kg

Package	Format	Size	Weight
S23'L Arm	Plywood crate	350x55x75 cm	294kg
S23'L Fulcrum & accessories	Plywood crate	94x55x84 cm	116kg
S23'L Dolly & Column	Plywood crate	139x94x76 cm	155kg
S23'L Counterweights & CW dolly	Pallet	120x80x60 cm	450kg

**The size and the weight of these packages are based on standard packages. It may change based on the customer order.*

9.3 OTHER DOCUMENTATION

ENCODER OUTPUT RESOLUTION & PINOUT FOR S10'

Encoder A/B phase: 90°

Z output: not available

PAN: Encoder Resolution: 19000 points

Gear factors: 162:12

Encoder output resolution: $(162 / 12) \times 19000 = 256500.0$ points/turn or **712.15 points/deg**

TILT: Encoder Resolution: 19000 points

Gear factors: 164:12

Encoder output resolution: $(164 / 12) \times 19000 = 259666.6666$ points/turn or **721.2962 points/deg**

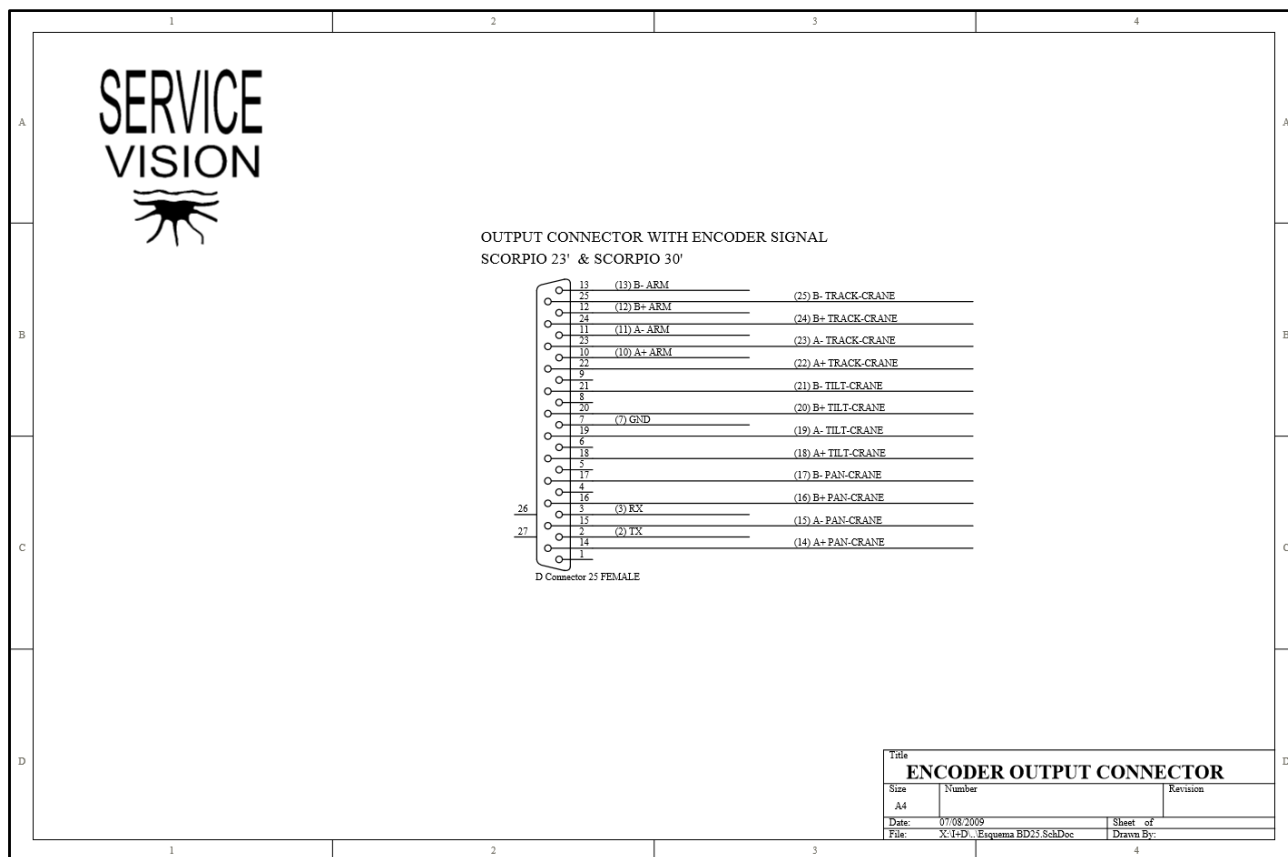
ARM: Encoder resolution: 1000 points

Motor turns: 38.5

Length: 2220 mm

Encoder output resolution: $(38.5 \times 1000 / 2220) = 17.3423$ points/mm

Note: This is the point resolution. If the reading is by flank it needs to be multiplied by 4. If the reading is by level needs to be multiplied by 2.



ENCODER OUTPUT RESOLUTION & PINOUT FOR S17'

Encoder A/B phase: 90°

Z output: not available

PAN: Encoder Resolution: 19000 points

Gear factors: 162:12

Encoder output resolution: $(162 / 12) \times 19000 = 256500.0$ points/turn or **712.15** points/deg

TILT: Encoder Resolution: 19000 points

Gear factors: 164:12

Encoder output resolution: $(164 / 12) \times 19000 = 259666.6666$ points/turn or **721.2962** points/deg

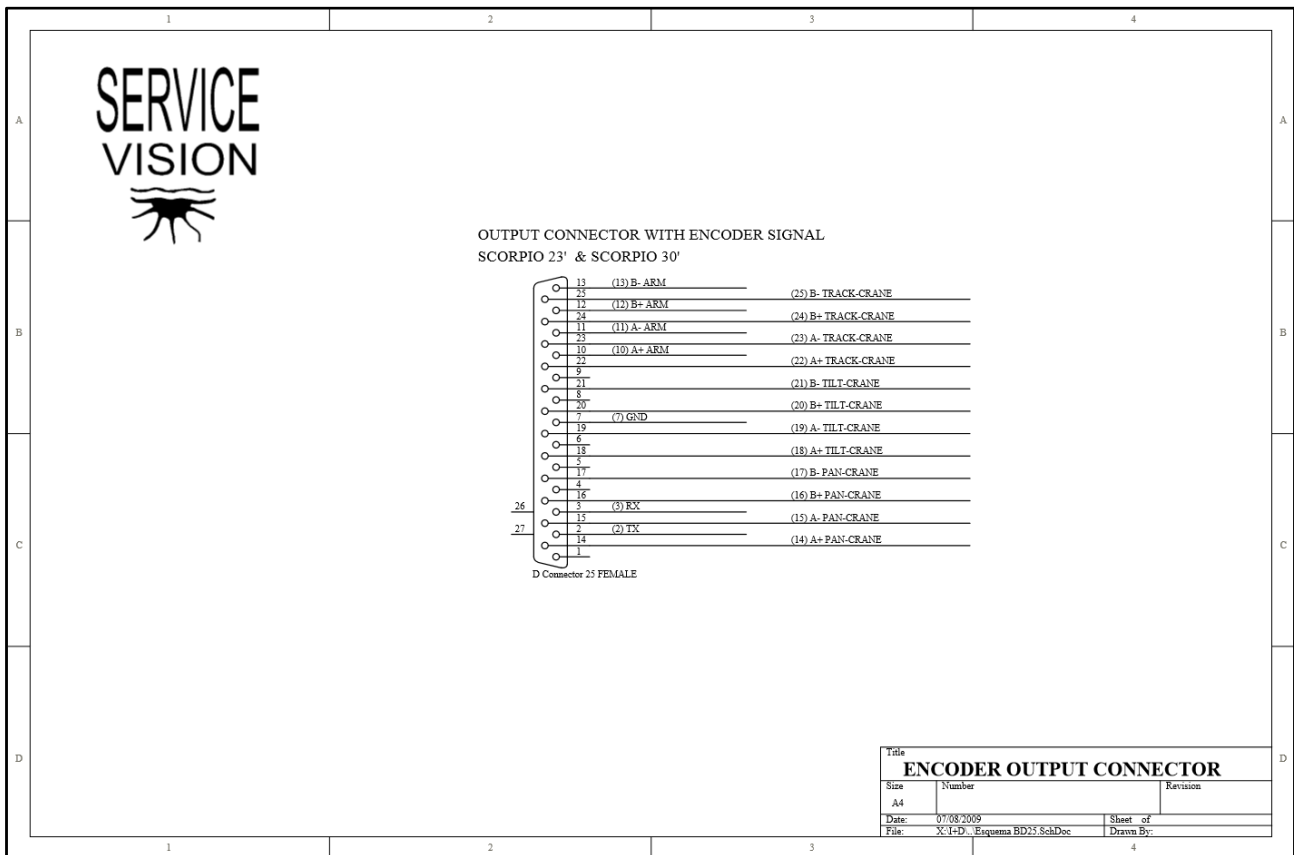
ARM: Encoder resolution: 1000 points

Motor turns: 67.5

Length: 3900 mm

Encoder output resolution: $(67.5 \times 1000 / 3900) = 17.3076$ points/mm

Note: This is the point resolution. If the reading is by flank it needs to be multiplied by 4. If the reading is by level needs to be multiplied by 2.



ENCODER OUTPUT RESOLUTION & PINOUT FOR S23'L'

Encoder A/B phase: 90°

Z output: not available

PAN: Encoder Resolution: 19000 points

Gear factors: 162:12

Encoder output resolution: $(162 / 12) \times 19000 = \mathbf{256500.0 \text{ points/turn}}$ or **712.15 points/deg**

TILT: Encoder Resolution: 19000 points

Gear factors: 164:12

Encoder output resolution: $(164 / 12) \times 19000 = \mathbf{259666.6666 \text{ points/turn}}$ or **721.2962 points/deg**

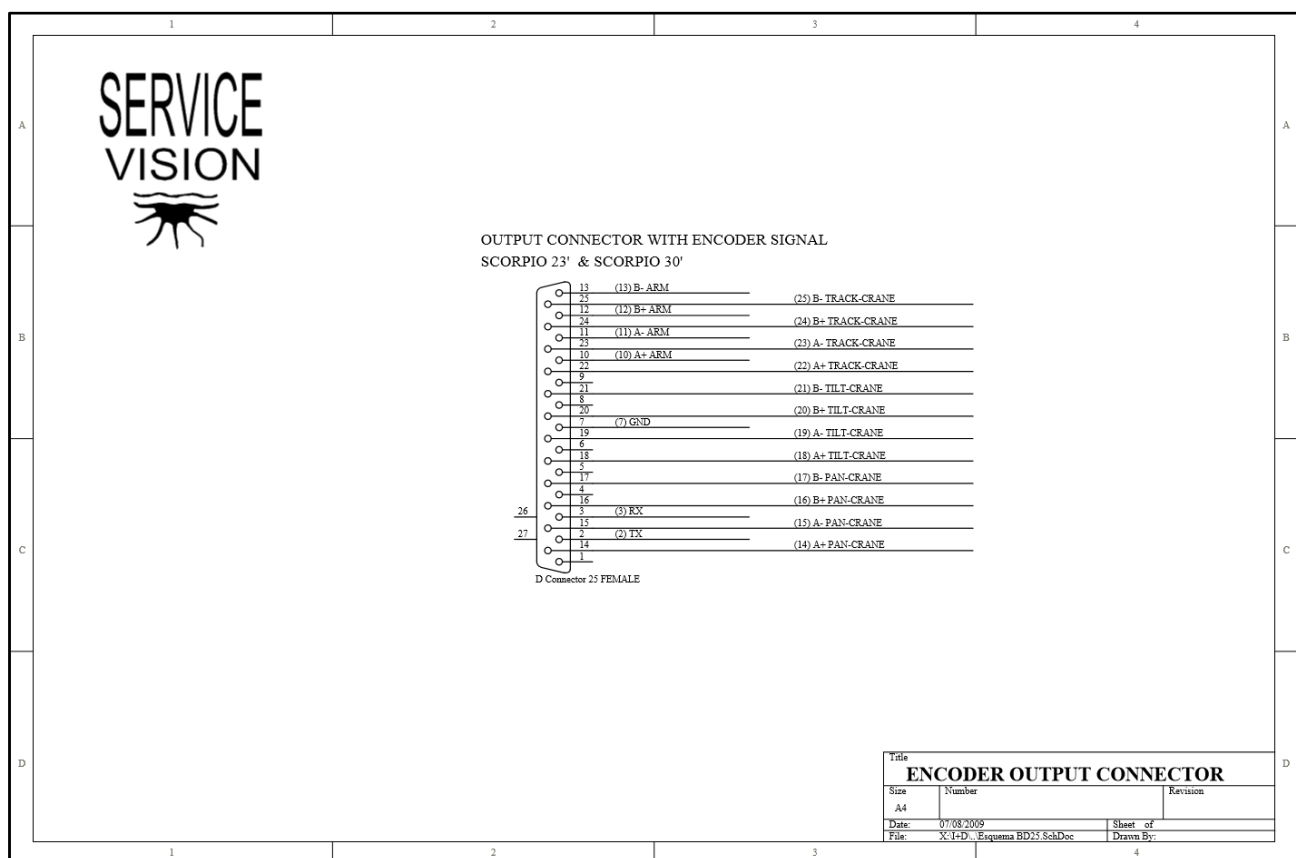
ARM: Encoder resolution: 1000 points

Motor turns: 95

Length: 5450 mm

Encoder output resolution: $(95 \times 1000 / 5450) = \mathbf{17.4311 \text{ points/mm}}$

Note: This is the point resolution. If the reading is by flank it needs to be multiplied by 4. If the reading is by level needs to be multiplied by 2.



CCU/SERVO DIP SWITCH CONFIGURATIONS

SERVO 9.00 (SERVO_I) BOARD DIP CONFIGURATION

BOOT								
SWITCH	1	2	3	4	5	6	7	8
BOOT	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SAd1								
SWITCH	1	2	3	4	5	6	7	8
LEVELING	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
LEVELING GM	OFF	ON	ON	OFF	ON	OFF	OFF	OFF
ARM 10'	ON	ON	ON	OFF	ON	OFF	OFF	OFF
ARM 17'	ON	ON	OFF	OFF	OFF	ON	OFF	OFF
ARM 20'	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF
ARM 23' LT	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
ARM 23'	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
ARM 30'	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
ARM 38'	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
ARM 45'	ON	ON	OFF	OFF	ON	OFF	OFF	OFF
PAN CLASSIC	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
TILT CLASSIC	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
ROLL CLASSIC	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
PAN MINI	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF
TILT MINI	ON	ON	OFF	ON	OFF	OFF	OFF	OFF
ROLL MINI	OFF	ON	OFF	ON	OFF	OFF	OFF	OFF
ROLL CONT	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF
CWE	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
CWE (LIMITS)	OFF	OFF	ON	ON	ON	OFF	OFF	OFF
CWE 45'	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF
CWE 45' (LIMITS)	ON	OFF	ON	ON	ON	OFF	OFF	OFF
MICRO HEAD	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF
DOLLY	ON	OFF	ON	ON	OFF	OFF	OFF	OFF
DOLLY(AUTO)	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
TOWER	OFF	ON	ON	ON	OFF	OFF	OFF	OFF
SCORPIO ARM	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
MINI HEAD EZ	OFF	ON	OFF	OFF	ON	OFF	OFF	OFF
MINI HEAD EZ (TILTDETECT)	ON	OFF	ON	OFF	ON	OFF	OFF	OFF
SCORPIO ARM GYRO PAN	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
SCORPIO ARM GYRO TILT	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
MOTOR FREEWHEEL	ON	ON	ON	ON	OFF	OFF	OFF	OFF

CCU C2000 BOARD DIP CONFIGURATION

SAD1

SWITCH	1	2	3	4	5	6	7	8
JOYSTICK 2.I	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
JOYSTICK 2	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
JOYSTICK 4.I	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
JOYSTICK 4.F	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
JOYSTICK 5.F1.2	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
HANDWHEELS	ON	ON	ON	OFF	OFF	OFF	OFF	OFF
HANDWHEELS EZ	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
JDR	ON	OFF	OFF	ON	OFF	OFF	OFF	OFF
HANDHELD	ON	ON	OFF	ON	OFF	OFF	OFF	OFF
CRANE(23,30,45)	OFF	OFF	ON	OFF	OFF	BOX	MOT	ENC
CRANE 10'	OFF	ON	OFF	ON	OFF	BOX	OFF	OFF
CRANE 17'-23'	OFF	OFF	ON	ON	OFF	BOX	OFF	OFF

- SCORPIO CRANE:

→ SWITCH 8 – ENCODER TYPE (ENC)

OFF: ENCODER E2

ON: ENCODER E1

→ SWITCH 7 – MOTOR TYPE (MOT)

	SCORPIO 30	SCORPIO 45
OFF	MOTOR MINI (HI-SPEED)	MOTOR 1
ON	MOTOR NORMAL	MOTOR 2

→ SWITCH 6 – ELECTRONIC BOX TYPE (BOX)

	SCORPIO 45	SCORPIO 10
OFF	BOX STANDARD	V1
ON	BOX 4K (HI-SPEED)	V2

BOOT

SWITCH	1	2	3	4	5	6
	ON	ON	ON	ON	OFF	ON

*DIP switch configuration at date 05/10/2020

10 CRANE ASSEMBLY PROCESS S10'

Before starting the assembly of the SCORPIO 10' it is important to identify all the transport plywood crates and know what is inside each one, thereby it will be more practical and intuitive.

10.1 DESCRIPTION OF THE PLYWOOD CRATES

The SCORPIO 10' is send in three lumps: one flight case, one plywood crate and one pallet. Inside the flight case there is the arm with the electronic box, leveling head and all the accessories of the arm. Inside the crate there is the dolly and the column with the tools to operate them and, in the pallet, there are the counterweights and the counterweight dollies.



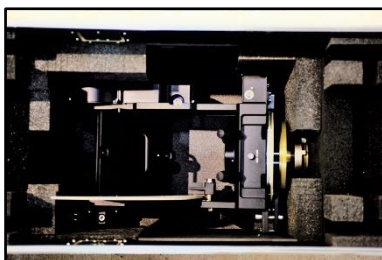
10.01 From left to right: S10' Arm flight case and Dolly & Column plywood crate.



10.02 CW & CW dolly pallet.



10.03 Arm flight case 1.



10.04 Arm flight case 2.

Inside the flight case there is the main arm. Under the main arm there is the counterweight support and the fulcrum as well as the rest of the accessories of the arm. To have access to these parts the arm must be taken out of the box.



10.05 Dolly & Column on the crate.

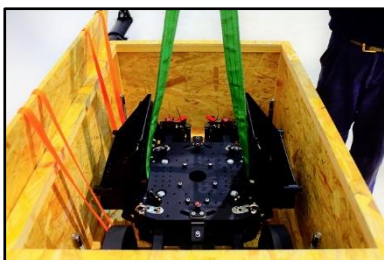


10.06 Column shipment.

In the dolly box there is the column on top of it. To have access to the dolly, the column must be taken out first.

10.2 CRANE ASSEMBLY

The first thing to do is to open the plywood crate and remove the column and the accessories until there is access to the dolly. It is recommended to lift the dolly using a forklift as seen in *fig.10.08*. With the dolly on the ground, the legs can be adjusted into a working position as seen in the [chapter 2.1.3 Articulated arms](#).



10.07 Dolly inside the box.



10.08 Dolly being pulled out of the box.



10.09 Steering assembly.



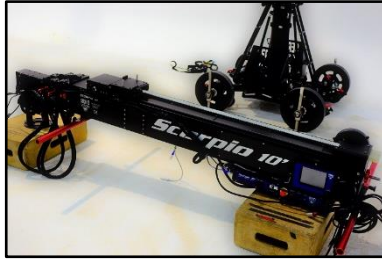
10.10 Column assembly.

The steering handles can be introduced to relocate the dolly base in another position by tightening their screws *DIN912 M10x30mm* (fig.10.09).

The column is attached to the dolly with the 6 screws (*DIN912 M10x25mm*) and secured with the tensors from the same box. Once attached, open the flight case, and remove the arm from it in order to have access to the fulcrum underneath.

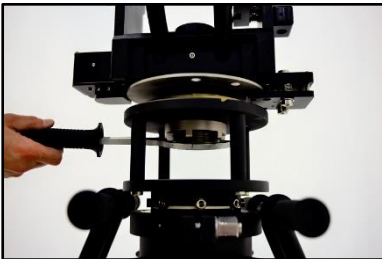


10.11 Tensors on the column.



10.12 Arm resting outside the box.

Remove the fulcrum, the bars and the counterweight support from the flight case and attach the fulcrum into the column using the mitchell mount tool.



10.13 Fulcrum being attached.



10.14 Arm being introduced.

With the fulcrum assembled, introduce the arm into it between two or more people or using lifting devices such as forklifts. Secure the arm with straps once it is in place and lock it to the fulcrum. Mount the counterweight support and the sidebars.



10.15 Bars being tight.



10.16 Crane assembled.

Now the crane is ready to be connected and used

In the event there is needed to mount an extra cable (BNC, Fiber cable...), the arm needs to be extended to reach the magnetic limit of extension. With the arm fully extended, attach the extra cables to the cables already mounted and move the arm in and out to verify the optimal behavior of the cable loom.

11 MARKS OF THE EQUIPMENT

In the crane there are different labels indicating serial number, max. weights over and underslung and the model of crane.

S10' CE MARK

The Scorpio 10' is in conformity with the rules of health and of safety imposed by DIRECTIVE 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery and amending Directive 95/16/EC (recast). The supplier attests that it conformed to the procedure imposed by DIRECTIVE 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery and amending DIRECTIVE 95/16/EC (recast) of the material to these safety regulations and health.

SERVICEVISION S.L.	
MODEL	SCORPIO 10'
SERIAL NUMBER	XXXXX
FABRICATION YEAR	20XX
ELECTRICAL TENSION	30 VDC
MAXIMUM AUTORITHED MASS	533 Kg.
MAXIMUM PAYLOAD UNDERSLUNG	60 Kg.
MAXIMUM PAYLOAD OVERSLUNG	40 Kg.



Service vision keeps the right to change or modify any specifications of the crane without being specified in this manual.